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DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED
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PREFACE.

Since the publication of the last volume of the Franklin Journal, a material change has taken place in the tenure of the work, and in the scene of the Editor's labours; both of which changes are likely to enhance its value. It was originally issued under the patronage of the Franklin Institute, and it is indebted for many of its subscribers to the exertions of some of the individual members of that body; the whole weight of its fiscal concerns, however, as well as of the literary department, rested upon the Editor. In the present arrangement, he has no concern whatever in the management of it, apart from his duties as Editor, it being now essentially the Journal of the Institute. An Actuary has been appointed, who transacts, at the Hall, all business relating to the distribution of, and subscription for the work. A large, and justly influential body, has thus become identified in its interests, with the success of the Journal, whilst the Editor is relieved from a very irksome part of the concern; and one which was indeed, in some measure, incompatible with the complete performance of his duties, as such. The work has drawn largely upon his funds, and has not yet repaid to him the amount of his actual expenditures; still he has enjoyed, what will ever be to him the most valued portion of his reward, the approbation of the intelligent, and the conviction that he was doing good, by diffusing the principles of science, and correct practical information, among the artizans and manufacturers of our country; a class of our fellow-citizens whose importance we are only beginning to appreciate correctly.

It has already become known to the patrons of the work, that the direction of the National Patent Office has been committed to the Editor. His induction into this station has been such as to afford him unalloyed pleasure, as his appointment has been made without the slightest reference to political considerations, and has been universally approbated. Whilst this station will enlarge the sphere of his usefulness, by putting into frequent requisition, that information upon the practical application of mechanical and chemical science, which it has been the labour of his life to obtain, it will also enable him, through the medium of the Journal, to lay open those stores of the genius and skill of our countrymen, which, although existing in the Patent Office, have hitherto been but very partially known. The succeeding volume of the Journal will, in consequence, undergo a slight alteration in its title, by the addition of the words, "and the recording of American, and other patent inventions."

Those persons who examine the English and other periodicals devoted to science and the arts, need not to be informed that numerous articles from the Franklin Journal have been republished in them with distinguished approbation; their conductors having been, generally, just in crediting, and liberal in awarding the meed of praise for our labours. The Editor is not aware that an inordinate share of vanity is one of his characteristics; he, however, feels that "the universal passion" is a powerful stimulant, and that the reward at which he aims has not decreased in its influence, with the increase of his years. After this, need it be said that he was gratified by the following remarks, which appeared in the preface to the last volume of the *Register of Arts*, published in London? "The major part of the matter introduced consists of original descriptions by the editor; the remainder are the contributions of intelligent correspondents, together with selections from contemporary journals, the most prominent of which is the Franklin Journal of Philadelphia, a work of singular excellence, and unrivalled in utility. To the learned editor of that work, and to our correspondents generally, we therefore gratefully make our acknowledgments for their valuable assistance."

Washington City, June 1st, 1828.

THE

FRANKLIN JOURNAL,

AND

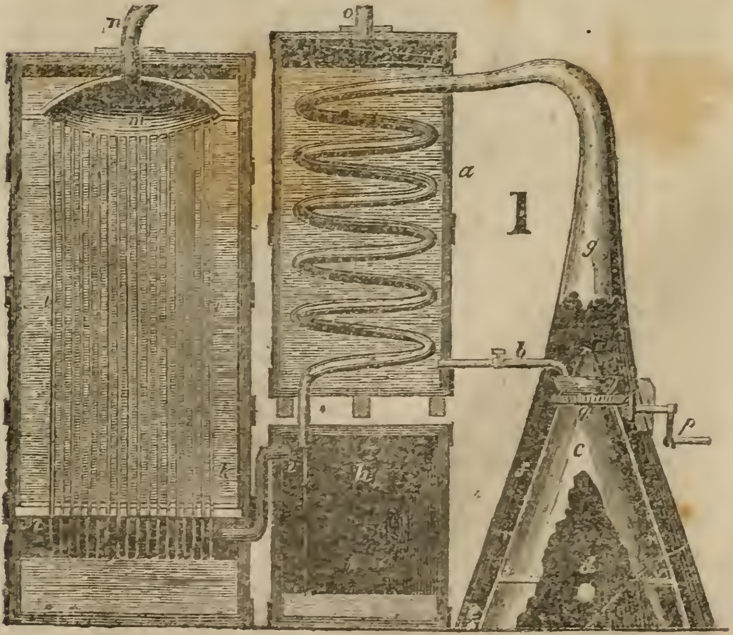
AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS,

Internal Improvements, and General Science.

JANUARY, 1828.

APPARATUS FOR EVAPORATION AND DISTILLATION.



Description of an Improved Apparatus for Evaporation and Distillation, which is also applicable to several other purposes, such as the concentration of saline liquids, the generation of steam, the manufacture of Vinegar, Verdigris, &c.

In the fifth number of the last volume we gave a description of some recent improvements in the distilling apparatus, and intended to have continued the same subject in the succeeding number, but were compelled to postpone it until the present period. The nature of the revenue laws of Great Britain, as relates to distillation, and various other important considerations, has led to numerous attempts to accelerate this process, some of which have been eminently successful. This subject is evidently connected with various efforts which have been made to improve the steam engine, as a main object in each, is the production of vapour, by means of fire. In many of the patents which have been obtained for improved modes of generating steam, the application of the same apparatus to the purpose of distillation has been pointed out; whilst in others, which were primarily intended to be applied to distillation, it has been proposed to use them also as boilers for steam engines.

The apparatus which we are about to describe, appears, from the letter of its inventor, not to have been subjected to the test of experiment, but to be a new proposition, submitted to the judgment of those who are acquainted with the subject. We perceive some practical objections to its use in certain of the ways designated, but think it worth presenting to our readers; for should it be, like most novel propositions, imperfect, it may yet suffice to suggest useful ideas to others.

The gentleman who proposes the plan, after making some remarks upon the known effect of increasing the surface in promoting evaporation, states that he was most forcibly struck with the rapidity with which the moisture from a wet towel was converted into steam, on holding it before a common fire, and says,

"I then thought that the towel afforded a hint for the construction of a steam generating apparatus, and that absorbent, porous materials, would be the best for the purpose, if they could be arranged conveniently, and were good conductors of caloric. Since then, it appeared to me that I might adopt metal, and apply a very extended surface for the generation of vapour, in a manner more convenient, than the close boiler; and with vastly greater effect, however shallow that boiler might be made.

"Having determined upon the form of my vessel, or rather *machine*, for the production of vapour, I next considered of a plan for its rapid condensation, in which I flatter myself I have been equally successful, notwithstanding it possesses much less novelty in its arrangements, than the former.

"I shall now describe my apparatus, with reference to the drawing, and at the same time show its application to distillation; and afterwards explain its adaptation to other purposes, namely, for evaporating the solutions of salt and sugar, necessary in the manufacture of those articles; for generating steam for motive engines; for the acetifying of vinegar; and for the manufacture of verdigris.

"First, as to distillation; *a*, fig. 1, is a tall cylindrical vessel containing the fermented *wash* to be distilled, which vessel is supposed to be regularly supplied by means of a pipe from the brewhouse. By turning the cock in the pipe *b*, the wash flows upon the *exterior* surface of the conical evaporator *c;* the liquid is first discharged into a small basin fixed round the cone near to its apex; which basin, having numerous minute perforations at the bottom, distributes the liquid equally over the whole surface of the evaporator in the thinnest possible stratum. The quantity of wash allowed to flow, may of course be regulated by the turning of the cock, and its uniform distribution may be assisted, if necessary, by spreading thin linen cloth, or wire gauze, (each has its peculiar advantages) over the surface of the cone, which would quickly absorb, or prevent the liquid running off too freely; *i. e.* before the required degree of vaporization was accomplished.

"The evaporating cone, I propose to be made of thin copper, and to be heated in that way which may be found the most convenient and economical; the means depending upon the circumstances of its locality. In the drawing, I have broken away the front of the cone, to show that it is hollow, and equally adapted to the application of heat to its surface, whether by direct fire, by heated air, or by steam. If by direct fire, a *very* small stove may be placed on the centre of its circular floor, and immediately over it, an aperture, or tube, for the supply of atmospheric air; the flue should descend, or an aperture should be made at the lower part of the side of the cone, in order that the upper part may be constantly preserved at the necessary temperature; the heated air having no tendency to descend and to pass off by the flue, nearly the whole of its caloric, would be usefully applied. If the tube which supplies the air were to pass through the brewhouse furnace, there would probably be no occasion for employing the stove before mentioned, when the furnace was in use, as hot air of sufficient intensity would occupy the upper part of the cone; the heat requisite being below that of boiling water. Should steam heat be desired, which is preferable on account of its easy regulation, it might be brought on from the brewhouse copper, by means similar to those described, and the condensed portion might run back into the boiler through the same pipe which conveyed the steam. But whatever may be the medium by which the heat is introduced, I apprehend that its application by this contrivance, will be more economical and effective for the purpose of vaporization, than any which has preceded it.

"I propose that the evaporating cone, be not heated to a higher temperature than 180° Faht.; to ascertain which, I would have a thermometer fixed in a convenient situation; and I would regulate the temperature by the turning of a cock, which would admit a greater or less quantity of steam. At the temperature mentioned, but a very small portion of aqueous vapour would be raised along with the spirituous; and by that means I would also separate the spirit, at the commencement of the process, from those matters which usually contaminate spirits of home manufacture. That portion of the wash that, owing to the low heat, escapes evaporation, (which would consist chiefly of water and extractive matter,) will run off at the bottom of the cone, along a circular gutter, and from thence pass out by an aperture or pipe, as at *e;* while the more spirituous, rises between the inner and outer cone *f f*, enters the neck *g*, and from thence proceeding through the spiral worm shown in the wash vat *a*,* is received into the recipient *h*, partly in the form of vapour, and partly in the liquid state.

"The more volatile portion of the vapour passes onward through the open tube *i*, into the great refrigeratory *k*. This is a large cylindrical vessel or vat, with a strong false bottom at *l;* on this rests a metallic apparatus, consisting of a great number of small tubes *t t*, open at each end, and fixed parallel to each other in a vertical position; their lower ends being soldered into a metallic bottom, and passing through it: the upper ends of the tubes, in like manner, are soldered and pass through the concave plate in the chamber *m*. This metallic apparatus being luted or soldered to the false bottom round its lower edge, all the vat above the false bottom *l* is kept filled with cold water by a service pipe inserted at the lower part. The vapour therefore passing through perforations in the false botton, rises up the numerous small metal tubes, by which it is separated into very narrow columns (into wires of vapour, if the term may be allowed,) and being thus exposed in metallic conductors to the powerful influence of the mass of surrounding cold water, its caloric will be very rapidly abstracted; the condensed liquid, which then runs back down the pipes, meets with the rising vapour in its progress, and by that means condenses a further portion at a higher temperature than would otherwise have been accomplished. I mention this circumstance here, to explain the reason, why I allow the vapour to proceed upwards, instead of forcing it downwards, according to the ordinary practice, which alteration I think may be deemed an improvement. By these arrangements I expect that very little vapour will reach the upper chamber *m*, if the temperature of the water is not allowed to get above 80°; but if the supply of cold water should be insufficient for the purpose, the vapour must of course proceed from the tube *n* to another refrigeratory.

"It is deserving of notice, that in this apparatus the process may be continued without stopping, as long as the fermented wash is supplied from the brewhouse, which is not the case with any other still. If it be required at any time to have access to the inner cone, a door made on the outer one (which should be kept luted during distillation,) will answer this purpose effectually.

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* The passing of the vapour through the vat *a*, has three advantages; the *first*, that of condensing a portion of the spirituous vapour; the *second*, the raising the temperature of the wash to about 160 degrees, so that it is discharged upon the still already in a heated state, and a very slight increase of temperature is sufficient to separate all its alcoholic constituents: the third results from the second; as the temperature will thus be raised to 160°, a very strong spirituous vapour will slowly collect in the upper part of the vat *a*, which may be conducted off by the tube *o*, into a separate recipient or refrigeratory, as the spirits thus produced will be of superior purity.

"I have proposed to cover the inner cone with cloth of some kind; this might be laid on in longitudinal sections, each piece forming an isosceles triangle, and stretched out to that figure by a stiff wire, which should also be curved to fit the convexity of the cone. These pieces might then be readily taken out at any time, and the deposit washed away, or others put in their places. If these triangular cloths were made of metallic gauze, it is probable the evaporation would be much expedited. It would, however, be desirable to do without these appendages, entirely; if the surface of the cone was slightly indented or grooved, the liquid might then be distributed evenly without the cloth, and be detained a sufficient time to complete the operations. There are several obvious modes of treating these points, which it would be tedious to describe, or to read. I shall, therefore, conclude the subject, as regards distillation, by explaining the use of the apparatus attached to the winch *p*. This winch is fixed upon the axis of a small bevelled pinion; this pinion turns a bevelled wheel *q*, which revolves round the upper part of the cone (against friction rollers,) and carries with it two long bars *r r*, the edges of which scrape or brush against the surface of the cone, to clear it of sediment or incrustations, which will then fall to the bottom: the bars *r r* are connected by a ring at *s*. Such an apparatus will be useful in the distillation of liquids that contain much extractive matter.

"Having concluded my observations upon the apparatus as a still, I proceed to notice its application to other purposes. For evaporation simply, the refrigeratory part of the apparatus is of course to be entirely dispensed with. In evaporating brine for obtaining salt, the double cones appear to me to be infinitely preferable to the immense open pans generally used in Cheshire and other parts. The salt makers proceed upon the improved plan of exposing an extended surface; accordingly, each of their pans measures several hundred superficial feet, and they are filled with the briny liquid to the depth of a foot or more. Now if the principle of extension of surface be right, which appears to be acknowledged by all scientific men, *the greatest extent to which the principle can be carried must have the preference.* Again, it is a most erroneous plan to expose the evaporating surface to the air, which of itself produces a considerable condensation, causing a portion of the vapour to fall down again into the pans, in the state of fine rain. Reason tells us that this must be the case: but the French have done more for us; they *proved*, many years ago, by direct experiment, that evaporation does not proceed so rapidly in uncovered vessels, as in those which are covered, with a pipe to convey off the steam. To complete the apparatus for the preparation of salt, the scrapers *r r*, already described, would be found particularly efficient and convenient.

In the concentration of vegetable solutions generally, but in particular that of sugar, my evaporating cones appear to me to have a decided preference over the open pans, commonly used in the West Indies and elsewhere. In the successive evaporations which the sirop undergoes, previous to the crystallizing process, the liquid is ladled from one vessel to another: in my apparatus this trouble is entirely dispensed with, the liquid continually running off, of itself. In the consumption of fuel, I conceive, there would be a considerable saving, as the caloric is applied with greater effect, and more economically, than by the usual furnaces; and the condensation of the vapour back into the sirop is prevented, by my external cone or covering, which excludes the evaporating surfaces from the air. My scrapers would also be applied very effectually in removing any incrustations that might form on the surface of the inner cone. The cones might be made of any magnitude, or several might be arranged a little above one another.

For the generation of steam for motive engines, I see no difficulty in its application; for that purpose, the rapid and economical production of vapour in strong vessels appears to me all that is required. I need not repeat that my extended surface and mode of applying heat would produce vapour with great rapidity; and it is obvious that the conical form offers great strength. For low pressure steam, a very thin internal cone would do; and for high pressure, a very thick one would not be necessary; as the expansive force would be exerted in that direction where the vessel was strongest: the exterior cone should however be of greater strength than the interior one, yet of a less substance than boilers in ordinary use; and it would be attended with this further advantage, that in case of the exterior cone bursting, very little damage would result; there would be no hot water to scald, nor any masonry to be blown up, or building destroyed in consequence.

In the preparation of Vinegar, it is a commonly received opinion, and I presume a correct one, that the acid property of the liquid is derived from its absorption of oxygen; the operation usually consists in exposing the liquid under fermentation, in open, or imperfectly closed, vessels, to the atmosphere. Now it has been found, that the oftener the surfaces of the liquid are changed, by agitation, or by ladling or pumping it out of one vessel into another, the sooner the vinegar is formed. The acidifying principle being thus obtained, it appears to me to follow, that that apparatus must be the best for the purpose, by which the most extended surface of liquid can be conveniently exposed to the influence of the atmosphere; accordingly I venture to propose my cones, before described, for this purpose also, but under certain modifications. First, I would have made a series of cones (of the cheapest materials) and of such relative dimensions, that they may be enclosed concentrically one within another, a few inches apart: the liquid in the thinnest possible strata, might then be allowed to flow over them, by similar means to that described in the first part of my letter. The effect of this arrangement would I think be a very rapid absorption of oxygen, or in other words, the speedy forming of the vinegar. By the plan described, I have supposed the cones to be open at top and bottom, for the air to circulate between them. It might *possibly* be an improvement to let all these cones terminate or open into one common tube; the air in which tube might be exhausted, by any convenient means, so as to increase the draft. An obvious and an inexpensive mode of producing this effect would be to supply the furnace with air for the combustion, from this tube, by which means a rapid current of air between the cones would be promoted. In vinegar manufactories a large furnace is almost always employed, whether in distilling the acid from wood, or in making a solution of malt.

Verdigris, as is well known, is a combination of the acetic acid with the oxide of copper: it is usually prepared by frequently wetting the surfaces of copper plates with vinegar, by various media, and when the copper becomes sufficiently coated with the green oxide, it is scraped off, and put into bags for sale. This operation is usually performed by removing the copper plates, (which are about 12 inches square,) from the racks in which they are laid, and the plates are, one by one, scraped with an instrument made for the purpose. The copper plates used are generally very light, weighing about 16 ounces to the superficial foot; I would use copper of much greater thickness, in constructing my cones, and place several of them concentrically one within the other; each of the cones should be provided with a pair of scrapers, and the bevelled wheel and pinion before mentioned, so that I might act upon them all by the turning round of one spindle; thus the verdigris, covering several very extended surfaces, might be scraped off *in a few seconds*. The cones would last a considerable time, as the metallic portion of verdigris is but a small component part of it.

ENGLISH PATENTS.

Account and description of Evans's patent distilling apparatus.

We shall introduce our description of Mr. Evans's New Apparatus, by which he proposes to remedy the defects of the old system, by inserting some observations made upon it, by the intelligent Editor of the Monthly Magazine, which appeared in July last; the invention is there announced in the following terms.

"Mr. Evans has constructed the model of a still, upon a new principle, which, if it answer on a large scale, will altogether supersede the old alembic. The theory of the machine is such, that it may, without hesitation, be pronounced the most decided improvement hitherto effected; for, if we mistake not, the still at present in use, remains in principle precisely the same, through the operation of the excise laws, that it was a century ago. Whatever improvements have been attempted, apply only to the rectification, while the first formation of the spirit is conducted in the same rude manner as in the infancy of science. We forbear entering into a more particular description, until the design be carried into execution upon a large scale. We should be extremely sorry, by premature publicity, to afford the continental distillers an opportunity of maintaining the superiority they have hitherto enjoyed, and we feel convinced, that we shall now take the lead in this important branch of our productive industry. The new apparatus, eminently combines economy in practice, and simplicity in construction; but the most valuable attainment, is the production of pure untainted spirits, which may be drawn in one operation, at any point of strength."

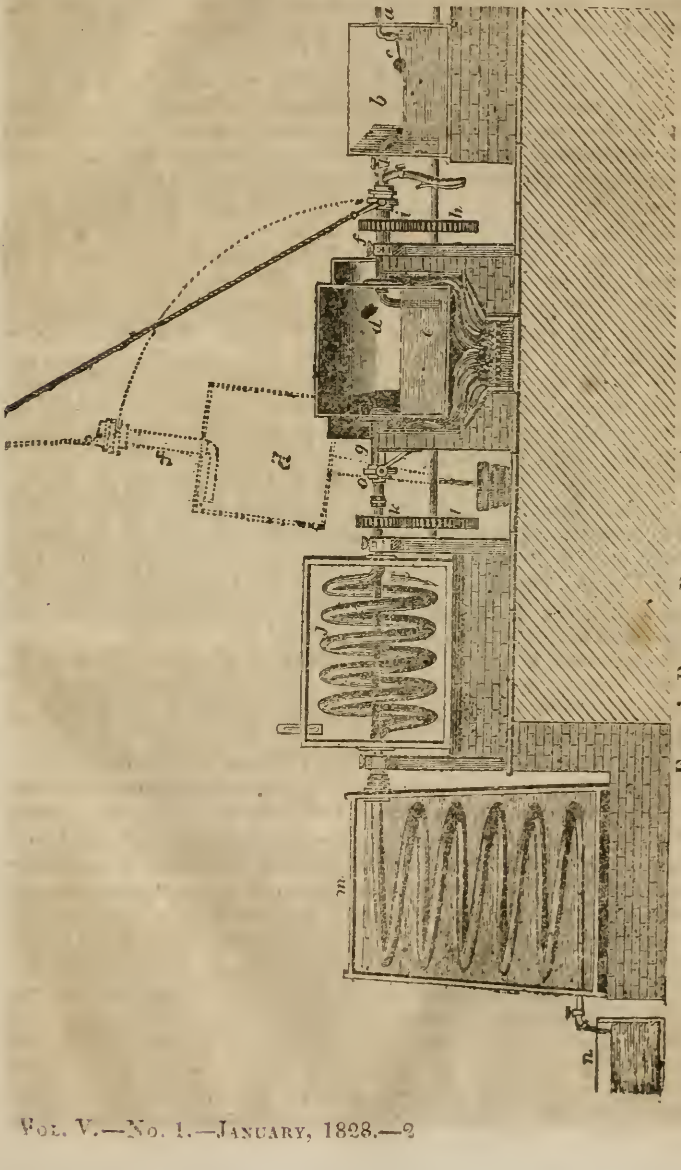
We have made such a drawing of the apparatus, as to show the whole operation at one view; *a* is a pipe which conveys the 'wash' or fermented liquor into a reservoir *b*, where it is maintained at a certain level, by the ball valve *c*. *d* is the still, which is a revolving copper cylinder, with ledges fixed in horizontal lines against the inner surface, to increase the agitation of the wash, as it turns upon its hollow axis, *f g*: its motion is derived from the spur wheel *h*, acting upon the pinion *i*, fixed on the hollow axis *f*. *j*, is the rectifier; this is formed of a large pipe of uniform bore, coiled up into the spiral figure exhibited, with the ends bent, so as to form axes for rotation, on one of which, a pinion *k* (corresponding with that at *i*,) is fixed, and this pinion is acted upon by another spur wheel *l*, on the same shaft as the other: *m* is the common distiller's refrigeratory, and *n* a receiver for the distilled spirit. The figure represented in dotted lines, is intended to show the position in which the still is drawn up, when it is necessary to cleanse it; for this purpose, there is at *o*, a universal joint of a peculiar construction, which enables it to be easily done, after having separated the connected tubes at the union joint, represented contiguous thereto.

The rectifier *j*, communicates with the still, through the hollow axle *g*, and with the refrigeratory, through a stuffing box; and the still communicates with the reservoir, by means of a syphon passing through the hollow axis *f*. The outward part of the syphon has two unequal limbs; the short limb inserted in the reservoir, is for the purpose of charging the still with the wash, and the long limb, for the purpose of discharging the spent liquor.

The operation is one of singular elegance, and our readers will, we doubt not, agree with us, that the novel and simple contrivances by which it is effected, evince a mechanical genius in the contriver, of no ordinary description.

In order to charge the still, the ball of the valve is pressed downward, so as to raise the liquid above the top of the syphon; this sets the syphon in action, and causes it to fill the still to the same level, as the liquid in the reservoir. Thus prepared, the fire is lighted, and a slow rotatory motion given to the still by the hand, or any other convenient first mover, applied to the shaft, upon which the spur wheels *h* and *l* are fixed. It matters not how fierce the fire may be, the continuous motion of the liquid prevents the formation of empyreuma, and those other ill effects incident to spirituous liquids in a fixed boiler. The agitation of the liquid in this vessel, and the intensity of the heat applied, cause a rapid production of vapour, which immediately enters the hollow axis *g*, and passes into the coiled worm of the rectifier *j*. It is here necessary to observe, that this capacious worm revolves in that direction pointed out by the arrow, consequently, whatever portion of the vapour becomes condensed in it, runs out at every revolution, back through the hollow axis *g*, into the still; and the hollow axis *g* is, for this purpose, made tapering wider towards the still, so as to give the liquid a descent to run freely into it.

The vessel *j* is, therefore, properly termed a rectifier, as it sepa-



Evans's Patent Distilling Apparatus.

rates the water from the diluted alcohol, before passing out of it into the refrigeratory *m;* in this, it arrives in a state more or less concentrated, according to the temperature preserved in the rectifier, which is regulated, as usual, by a thermometer; the spirit may, consequently, be drawn at one operation of almost any required strength.

A very interesting feature in these new arrangements, is the mode of applying the syphon; which is constantly supplying the still with fresh wash, in place of that which has been vaporized, and this operation is uniformly continued during the rotation of the vessel, owing to its passing through a tubular axis: the syphon, in like manner, enables the still to be discharged without stopping the machinery. When it is necessary to re-charge the still with the fire under it, a thick cast-iron sliding plate is drawn from the back, so as to interpose itself between the fire and the still, and thus prevent any injurious effects to the contents of the latter. When fuel that does not emit much smoke, such as coke, or anthracite, is employed, the grate itself may be drawn out from under the still, by placing it upon castors, or rollers, and without inconvenience, as the time necessary to renew the operation of charging, sufficiently to prevent burning, is only the work of a few moments.

We shall here close our remarks, by acquainting our readers that this invention does not emanate from the wild speculations of a mere theorist; for Mr. Evans is an inquiring practical man; and his observations, and his experiments, have convinced him that alcohol is *not* altogether the result of the vinous fermentation, but *the product of a subsequent elementary change*, effected at a higher temperature, which hitherto could not be ascertained, for the want of an apparatus such as we have described. Upon Mr. Evans's principle of construction, any temperature may be uniformly applied to the whole mass of liquor; while by the old vessels this is impossible to be done, without injury to the products, for reasons before given.

It is likewise particularly deserving of notice, that there is a considerable economy in the application of heat by this method, for the fire acts uniformly upon the whole of the surface of the still, but in those of the ordinary construction, the fire does not act upon more than one-third, or one-fourth of the surface. [*Register of the Arts.*

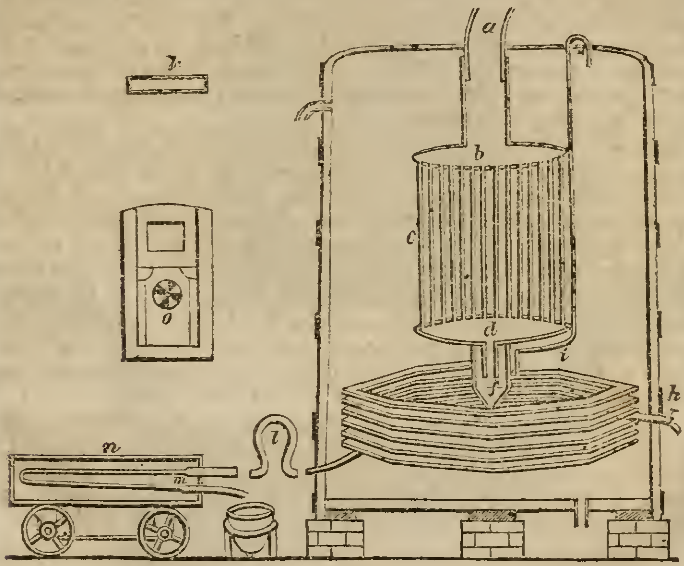
Williams's Patent Apparatus for Distillation.

THE improvements projected under this patent are comprised under the following heads; viz. an enlarged capacity of the still-head, to cause a separation of the aqueous vapour by condensation, previous to its passing over the neck of the still, into the spirit condenser; in the employment of numerous small vertical tubes surrounded with cold water, to increase and accelerate the condensation; in the adaptation of a peculiarly constructed "cooling worm," by which, it is conceived, the quantity of spirit will be increased by preventing evaporation in its progress to, and when in the receiver;

and in the employment of refrigerating saline mixtures, for the more effectual cooling of the spirit in warm climates, or in warm weather.

This invention has been patented about six years, which circumstance gives it greater claims upon our admiration, than if it were the invention of this precise period of time, so fraught with great improvements in the art of distillation; many of which, however, appear to us to have been indebted in a great degree, to this fine example.

In the body of the still, (that part where the vapour is generated) there is no improvement proposed, but an enlarged capacity of its globular head, to cause the watery particles to fall back into the still; this part of the apparatus we have omitted in our diagram, as it requires no additional explanation; the engraving, therefore, relates wholly to the apparatus for condensation.



a is the termination of the neck of the still which conveys the vapour into the "upper drum" *b*, whence it is divided among a number of small vertical tubes *c*, which the patentee says, should not exceed ¾ of an inch in their interior diameter. As the tub inclosing this apparatus is filled with cold water, the condensation immediately commences in the upper drum, and is completed in its subsequent progress through the vertical tubes, and the "lower drum" *d*. From thence, the fluid runs down a central neck *e*, into the trap *f*, from the upper part of which trap it enters the cooling worm *g*. It is evident that the trap *f* is, in working, always partly filled with liquid, and the neck *e* being immersed therein, any vapour which may have escaped condensation can pass no further. The trap *f* has a funnel-shaped bottom, from which a pipe *h* passes through the coils of the worm, and through the side of the tub, where it is furnished with a cock, for the purpose of drawing off any impure spirit, which may be separated from the wash in the first stage of the process; and to discharge what may remain in the trap when the process is over. To the trap *f* is also attached another pipe *i*, called the safety pipe, for the purpose of allowing "the egress and ingress of atmospheric air, from, and to, the condenser, to prevent both pressure, and a vacuum, therein." The coils of the cooling worm are made octangular; the worm itself is made flat, and of considerable breadth: a transverse section of it is exhibited in the separate figure *k*, which shows it to be in the form of a parallelogram, whose longest sides are four inches, and its shortest half an inch wide. This octangular worm, after making six complete turns, assumes a circular shape and diverges off to pass through the side of the tub; at its end, outside the tub, which is made a little tapering, is fitted, and is to be occasionally applied, a crane-necked pipe *l*, which pipe may be elevated or depressed at pleasure, for the purpose of keeping three or more of the coils of the worm full of liquid. This crane-necked pipe is intended to be applied in hot weather, or hot climates, to cool the spirits more effectually, and prevent their evaporation, by subjecting the same in a greater degree to the effect of the cold water in the worm tub.

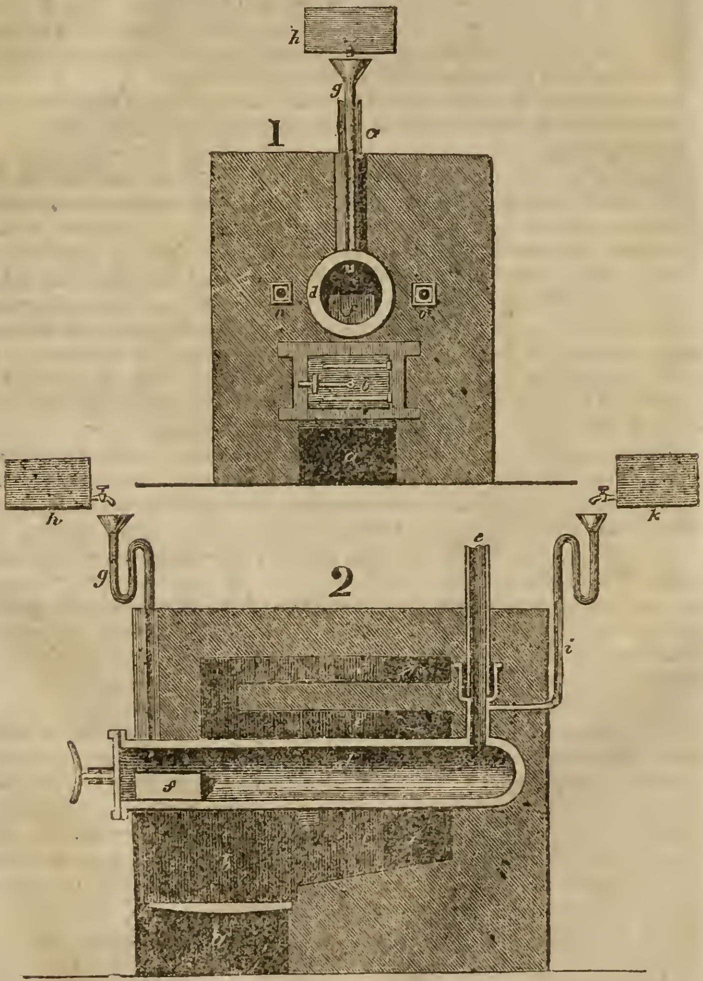
An additional apparatus to be used in hot climates, of undoubted utility, is likewise recommended by the patentee, and claimed by him as his invention. It consists of another pipe *m*, into which the discharging end of the crane-necked pipe is made to enter, and which pipe, after passing the end of the trough *n*, is made of a very broad flat shape, and running the whole length of the trough, (which may be of any extent;) it is then to return by a very slight descent, so as to run back very gently into the funnel of the pipe which conveys it into the receiver.

The trough *n* may be supplied with Glauber's salts and nitre, or any saline mixture capable of producing intense cold, for the more effectual cooling of the spirit; the trough may be placed upon wheels and axles, for the convenience of bringing it to, and conveying it from, its required situation.

The patentee further recommends, but does *not* claim it as a patent right, that the ash-pit of this still, as well as of stills generally, be furnished with a plate iron door, in which is to be introduced near its top, one or more registers, as shown in the separate figure at *o*, the apertures in which may be closed, more or less, to produce the required draught, and thereby enable the distiller to check, or increase, the ebullition at pleasure, and with the greatest facility.

Gas Apparatus.

Account of the apparatus for which a patent has been obtained by Wm. Vere, engineer, and Henry S. Crane, manufacturing Chemist, for improvements in the manufacture of Gas for illumination; and especially for the decomposition of coal tar for that purpose.



In the generation of sub-carburetted hydrogen gas, from coal, great inconvenience has been sustained by the deposition of adhesive matters in the pipes leading from the retorts, by which they gradually became choked up; it, in consequence, became frequently necessary to suspend the process, for the purpose of clearing out the deposit. A considerable quantity of tar is also obtained as a separate product in the gas manufactories; in some of them, this tar was afterwards decomposed, for the purpose of generating gas, (which it yields in considerable quantity) but it was discovered, that the tar, thus employed, caused a greater evil in the pipes by a deposition of asphaltum, which quickly rendered them unserviceable: besides this, it was found that the gas produced from this material afforded but a feeble light, and emitted much smoke: for these reasons, the decomposition of coal tar was discontinued in most manufactories.

As a remedy for these evils, Messrs. Vere and Crane have devised the invention delineated in the accompanying engraving. The specification states the apparatus to be applicable to the distillation of coal, coal-tar, tar-oil, oil, vegetable oil, animal oil, and all other solid or liquid matters, from which carburetted hydrogen may be obtained; and the process consists in introducing a constant stream of water into the retort, or a current of steam into the exit pipe; which, mixing with the volatile matters, as they rise from the substance under decomposition, causes them to fall down again into the retort, without proceeding further to choke up the pipes, while the more gaseous products pass on through the steam, in a more pure state, to be afterwards treated in the usual way. The gas obtained from tar by this process, is said to burn with a brilliant white flame, instead of the dull, smoky light, as before mentioned.

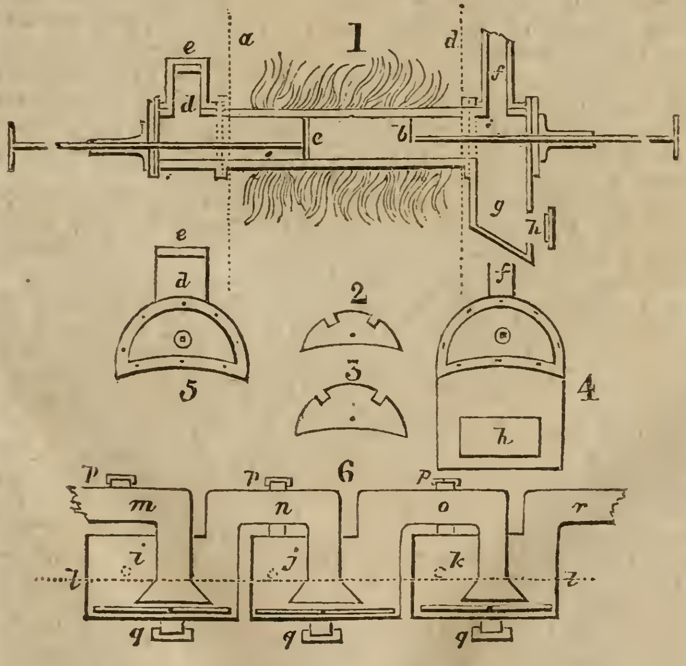
Fig. 1 is a front elevation of the improved retort, set in the brickwork of the furnace.. *Fig.* 2 is a vertical section of the same, showing more advantageously its construction, and the mode of operating. The letters have reference to the like parts in each of the figures.

a is the ash pit, *b* the furnace, *c c c* the flue winding round the retort; *d* the retort, with its lid fastened in the usual way, by a cross bar and screw; *e* the exit pipe, through which the gas escapes as it is generated; *f* is a wrought-iron pan, or tray, to hold tar, or other liquid matter to be distilled; *g* a supply pipe to *f*, leading from the cistern, or reservoir, *h; i* is a water pipe, and *k* a cistern of water.

When tar, for instance, is to be operated upon, the retort partly filled with coke, or broken bricks, is to be brought to a bright red heat, which may be ascertained by inspection through the holes *o o*, shown in *fig.* 1, which are provided with stoppers; the cock of the water pipe is then to be opened, to admit water to flow, in a slender stream, into the retort, the heat of which immediately converts it into vapour; this done, tar is to be admitted from the reservoir *h* to flow through the pipe *g* into the pan *f*, where it is quickly decomposed; the gas, as it ascends and enters the exit pipe, necessarily passes through a large volume of steam, which causes an instant precipitation of the carbonaceous matters, which would otherwise lodge in the pipes, and ultimately obstruct the passage of the gas through them. The gas, thus relieved of the principal contaminating matters, has then to pass through the ordinary purifications, by which it is ultimately brought to a state of great purity, for consumption.

When coal, or other solid matters, are to be decomposed, for obtaining the gas, the pan *f*, the pipe *g*, and the reservoir *h*, are to be removed, and the operation is to be conducted without them; retaining, however, the use of a current of steam, as in the former case. The quantity of water required for this purpose, will depend upon the nature of the material under distillation; but, in general, eight or ten gallons of water to 1000 cubic feet of gas will be found adequate to the precipitation of the carbonaceous matter. The stream of water should of course be constant and uniform; and it would be desirable to introduce a current of steam from an engine boiler, if there be one on the premises, in lieu of the water, especially when operating upon coal.

Description of the apparatus for obtaining, and purifying, gas from coal, for which a patent was obtained by Mr. Hobbins, Ironmonger.



The accompanying drawings represent a new construction of retorts for the generation of the gas, and an improved apparatus for its subsequent purification. The advantages expected to result from these arrangements are, first, an increased facility in charging the retorts with coal, and afterwards in discharging them of the coke resulting from the separation of the gas, thereby considerably reducing the labour of the stoker, or attendant of the fire. Secondly, in affording a simple and ready means of spreading the coal over the retort, in a thin uniform stratum, thereby equalizing the temperature of the coal throughout, rendering the luting of the joints unnecessary, and causing a speedy separation of the gaseous products; the whole operation requiring but ten minutes. The purifying vessels adopted by the patentee are of two different constructions, but both are in principle, somewhat similar to a Woulf's Distillatory Apparatus; in them, the gas is made to pass successively, through several vessels, charged with lime or other purifying materials, and the chemical action which takes place from the contact of the gas, produces a constant agitation, without the necessity of resorting, as usual, to mechanical aid.

Fig. 1 shows a longitudinal section of a retort, supposed to be placed in the furnace, occupying the space between the two dotted lines *a a;* the two ends of the retort are flanched on to the body, and projecting beyond the brickwork, are removed from the influence of the fire. *b* and *c* are two scrapers, with long rods attached to them, which pass through the flanched ends of the retort, and have cross handles at their extremities; as the scrapers have to be pushed the whole length of the retort, the rods should be about a foot longer than the latter; as this proportional length is not shown in the engraving, they are exhibited as broken off near to the handles. The form of the scraper *b* is shown by the separate figure 2, and the form of *c* by the separate figure 3; in each of them are two square notches, which sliding upon square bars of iron placed longitudinally on the upper side of the interior of the retorts, are thereby suspended to it, and kept uniformly in their proper positions.

The process of working the retort is as follows:—Previous to charging it, the scraper *c* is drawn outwards from the body of the retort close up to the end, and the scraper *b* is pushed inwards so as to come in contact with *c;* both scrapers being then beyond the opening *d*, the charge of coals is admitted through the latter, by opening the cover *e*, which may turn upon a hinge joint, or be lifted up by means of a pulley and counter weight. The scraper *c* is then drawn back from its recent situation (beyond *d*,) which spreads the coals out in an even layer, all over the bottom of that part of the retort exposed to the action of the fire. About a foot from each scraper, the rods are connected by a solid and hollow screw, so that when the rods are drawn out, they may be removed out of the way by unscrewing them at those parts. As the distillation of the coal proceeds, the gas escapes by the tube *f*, and from thence to the purifying vessels. When all the gas has been separated from one charge of coals, the scraper *c* is thrust forward, pushing before it and clearing out all the coke, which falls into the coke-box *g*, previously closed by the mouth-piece *h;* from this receptacle, the coke may be afterwards let to fall into a barrow, and be wheeled away.

As it necessary that the apertures for the admission of the coal, and the discharge of the coke, should be closed air-tight; the patentee has availed himself of the distant, or screened, situation of these parts from the heat of the furnace, to adapt a lining of lead to the covers, by which means they are closed as effectually as by the troublesome process of luting the joints at every charge. To recharge the retort, both the scrapers are again thrust back beyond the opening *d*, when a similar quantity of coals is admitted, which are spread out again in an even layer, by drawing back the scraper *b*, and the distillation re-commences. The process is in this manner repeated as long as the production of gas may be required.

It should be noticed, that the ends are connected to the body of the retorts by flanches screwed together, so that when the furnace has destroyed the latter, a new one may be screwed on to the ends of the old retort, at a comparatively little cost, instead of having them wholly new. From each end of the retort, a tube projects horizontally, about ten inches long, and one inch in the bore, which serves both as a support, and a guide, for the scraper rod which slides through it.

Fig. 4 gives an external view of that end of the retort where the coke is discharged, and *fig.* 5 a similar view of the other end of the same, where the coals are received: the letters have reference to the like parts in each of the figures.

The purifying vessels proposed by the patentee, are of two descriptions; we have selected that for our engraving which we consider to be the best, but shall give some account of the other.

Fig. 6 gives a vertical section of a series of three vessels, *i j k*, the lower parts of which, up to the dotted line *l l*, are occupied with a stratum of lime, or other purifying material. The impure gas from the retort is first received into the tube *m*, and by its pressure descending along the bent arm, it passes out of the expanded, or bell-mouthed, end, where it mixes with the lime in the vessel *i*, and deposits therein much of its impurity, by condensation; from this vessel, the gas again rises and enters the tube *n*, from thence, filtering through the lime in the vessel *j*, it re-ascends, and enters by the tube *o*, into the third filtering vessel *k*. The pressure upon the gas being constant, the filtration may be repeated through any number of these vessels, but the extent of the process already described will, in general, be sufficient to produce gas of great purity; in which case it would be conducted by the tube *r* to the gas-holder, for subsequent distribution.

The three covered tubes *p p p*, above the filtering vessels, are for the purpose of charging them with the lime; the dotted circles are perforations in the sides of the vessels (furnished with plugs,) for ascertaining the depth of the stratum of lime, &c.; and the three tubes *q q q* at the bottoms of the vessels, are for discharging the lime when saturated with the various matters that have been condensed during the process of filtration. To aid the complete discharge or clearing of these vessels of their contents, three bars of iron are employed as scrapers, one in each vessel, and nearly of the same length; a rod, as a handle, is screwed into each, which passes through a hole (provided with a stuffing box) in the side of each vessel.

The other form of purifying vessels, proposed by the patentee, will, perhaps, be understood by the following description. A large cylindrical basin is divided internally by a series of circular partitions, placed concentrically; on the bottom of the whole, the stratum of lime, or other matter, is laid. Over these partitions are placed in an inverted position, a number of circular vessels one within another, and arranged alternately between the partitions, with their edges imbedded in the layer of lime. The gas, which enters by a tube through the centre of the bottom of the larger exterior vessel, first ascends over the innermost partition, and thence descending by the interposition of the bottom of the innermost inverted vessel, it is compelled to enter the first portion of the stratum of lime; having filtrated through this, it passes up between the outside of the inverted vessel and the next partition; passing over this, it descends on the other side of the last-mentioned, and enters a fresh portion of lime; and so on, from compartment to compartment, until the purification of the gas is completed, when it is conducted into the gasholder ready for the purposes of illumination.

Gas and Vapour Engines.

Some remarks upon explosion and vapour engines. By the Editor.

It is now upwards of three years, since Mr. Samuel Brown's gas engine was introduced to public attention; and from the ingenuity of its construction, and the sanguine expectations of the projector, and some of his friends, it excited an unusual degree of interest. The principle of its action was by no means novel, the production of a partial vacuum by the combination of explosive mixtures of atmospheric and inflammable air, had been long spoken of, as a substitute for that power obtained by steam. In the year 1814, a model of an engine acting upon this principle, was placed in the hands of the Editor, with a view to his instituting some experiments with it. The inflammable gas to supply it, was to be obtained from the charring of wood; and it was imagined, that the charcoal produced, would go far in defraying the expense of working it. The model was rudely made, but appeared to work with considerable power, and the subject would have been pursued, but for the removal of the Editor to Virginia, on which account the model was returned to the inventor, and it is believed that no further effort was made to perfect it, and thus, the time and money which would probably have been uselessly expended upon it, were saved.

Since that period, several attempts have been made to apply the same principle, either by using inflammable gases, or the vapour from fluids which are volatile, and combustible; hitherto, however, these efforts have been unsuccessful, and we have strong doubts, whether under any ordinary circumstances, an engine operated upon by an explosive mixture of gas, or vapour, will ever be constructed, which will successfully compete with the steam engine.

The want of success, which has attended the ingenious and persevering efforts of Mr. Brown, renders it less necessary to urge our objections, than it would have been two or three years ago. There does not appear, in the successive attempts to perfect this engine, any deficiency of genius, perseverance, or funds; and yet, so far, we believe, it must be pronounced to be a failure. One of the main difficulties which has been experienced, has arisen from the large quantity of gas consumed, which has, to an enormous extent, exceeded the calculations originally made; such at least is the information which we have received, and that, from sources entitled to credit.

Having in our possession an engraving of Mr. Brown's engine, as constructed by him in the year 1824, and as we are not aware that its structure has been exhibited in any of our Journals, or in any other work published here, excepting Nicholson's Operative Mechanic, we have determined to insert the engraving, and description, which we doubt not will be acceptable to our readers. We have spoken of this engine as a failure; we ought, however, to state, that such is not the opinion of the inventor: an engine upon Mr. Brown's principle has recently been constructed in this city, by his son, who came from England for that purpose, under the patronage of one of our most respectable fellow citizens. This engine, although not actually completed, is so far so, as to have been set in operation; the question of its value, in the form it has now assumed, will, therefore, soon be settled. Mr. Morey is also here, with the design of completing one of his explosive engines, an account of which we formerly published. This, in its structure, differs considerably from Brown's; it has two cylinders with pistons; these cylinders are alternately filled with air, and vapour from heated spirits of turpentine; this mixture when ignited by a taper, explodes, expelling nearly all the air through an opening in the bottom of the cylinder, which bottom is formed of leather, in such a way that it operates as a large valve, allowing free exit to the heated and expanded air, and closing so as to prevent its return; the pressure of the atmosphere operates upon each piston, alternately, as it would in an ordinary atmospheric engine with two cylinders.

Engines, analogous in principle to the ordinary steam engine, but acted upon by the elastic force of vapour from different volatile liquids, have also been constructed, or proposed; and several patents have been obtained for them. The objections to these, appear to us to be insuperable; for although there is no theoretical obstacle in the way of their operation, the practical difficulties which present themselves, have hitherto caused, and are likely to insure, the abandonment of all such attempts; whenever we meet with accounts of such in the journals, we expect the same fate to attend them, which we know await those numerous advertised *improvements* which sin against the established laws of nature; not that we esteem them alike absurd; alcohol, ether, quicksilver, or any other volatile fluid, may be used to work an engine; the attempt, therefore, to employ them, is a legitimate object of pursuit, its attainment is within the bounds of possibility, and although it may ultimately fail, the effort may yet reflect great credit on the individual who makes it.

One of the vapour engines for which a patent has been obtained in England, will be found figured and described after that of Brown; we do not deem it necessary to make any particular remarks upon its structure, as our objections are of a general nature, resulting from the unavoidable defects in workmanship, and the necessary consequences of wear, and derangement, incident to all machines, and particularly to those which are massive.

Description of Mr. Brown's engine, in that form of it in which it was intended to raise water, which afterwards flowing upon an overshot water wheel, was to give motion to machinery.

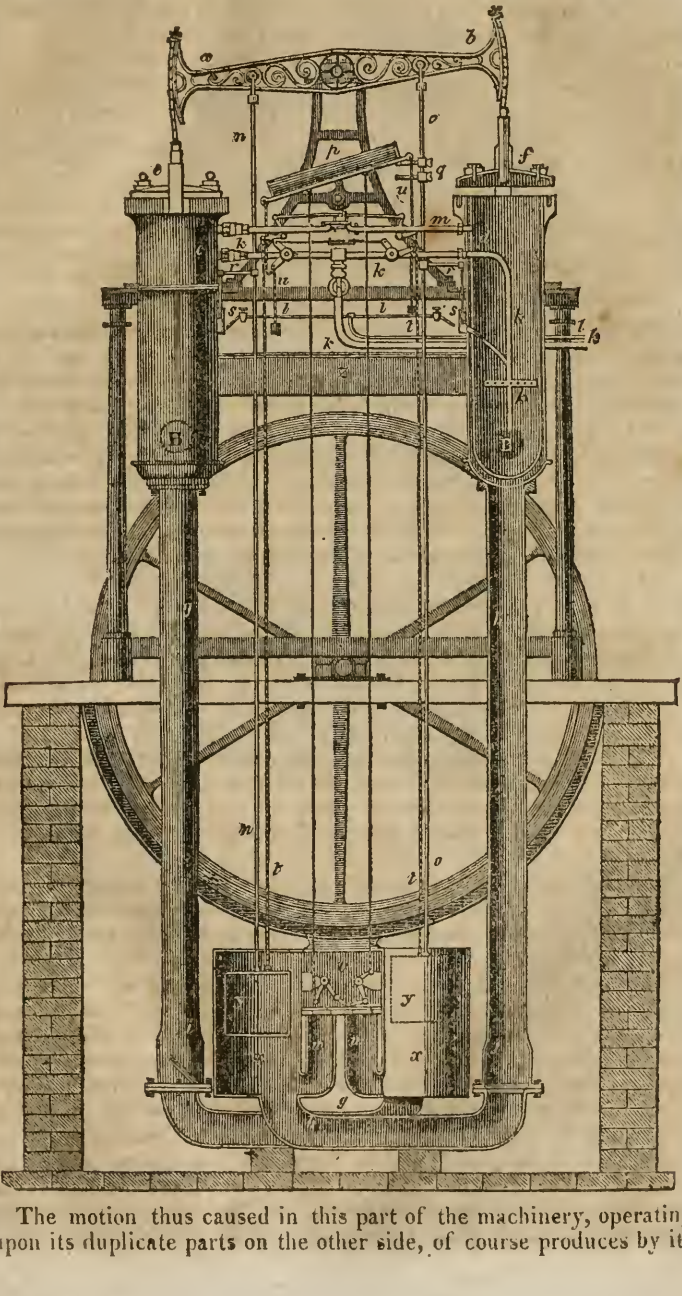
The two cylinders, *c* and *d*, are the vessels in which the vacuum is to be obtained; from these descend the pipes *g i g* and *h j h*, leading into the lower cylinders *x x*, which communicate with a reservoir of water, and from which the water rises along those pipes to fill the vacuum cylinders alternately. The water thus supplied is discharged through the pipes B into the tank or trough *z*, whence it falls upon the overshot water-wheel, and by the rotatory motion thus produced, gives power to such machinery with which it may be connected. The water runs from the wheel, along a case surrounding its lower half, into a reservoir *v*, from which the lower cylinders *x x* are alternately supplied.

In order to produce the vacuum, the necessary quantity of gas is supplied to the cylinders by means of the pipe *k k k*, to be conveniently attached to a gasometer. The gas also passes along the small pipe *l l*, (communicating likewise with the gasometer), and being lighted at both ends of that pipe, is constantly burning for the purpose of igniting the gas within the cylinders.

The water in the reservoir *v*, passing down one of the pipes *w* into one of the lower cylinders *x*, causes the float *y*, in that cylinder, to rise, and pushing up the rod *o*, raises the end *b* of the beam, which of course draws up with it the cap *f*, and forces down the cap *e* of the other cylinder *c*.

The gas being admitted along the pipe *k*, the flame from the pipe *l* is now freely communicated to the gas in the cylinder through the orifice, by the opening of the sliding valve *s*, which is raised by the arm *r*, lifted by the rod *o*, by means of the beam.

To produce the intermitting action of each cylinder, some subordinate machinery is put in operation, by chains and rods attached to a glass or iron vessel *p*, partly filled with mercury, and, turning upon a pivot, each end receives its movements of elevation and depression from the rise and fall of the projecting arms *q*, by the action of the beam above; the mercury being furnished for the purpose of regulating the supply of the gas into the cylinders, and the movement of the slide in the trough *v*. By the action thus communicated, the water from the reservoir flows down the pipe *w* into the vessel *x*, and produces the elevation of the float *y* and the rod *n*, and raises the cap *e* by the ascent of the beam at *a*.



The motion thus caused in this part of the machinery, operating upon its duplicate parts on the other side, of course produces by its action, a corresponding movement; and the slider in the trough *v*, moved by the action of the mercurial tube *p*, being removed from its position, allows the water to fall into the other pipe *w*, and as it ascends, suffers the float *y* to descend, and rising into the main cylinder, thus lifts again the beam at *b*, and its connexions, and forces down the cap *e* on the top of the other cylinder.

After the vacuum is effected in the cylinders, the air must be admitted, to allow the water to be discharged, and the caps to be raised: this is accomplished by means of a sliding valve in the air pipe *m m*, acted upon by chains *t t*, attached to the floats in the reservoir, and as motion is given to them, the valve is made to slide backwards and forwards, so as to allow of the free admission of atmospheric air.

Chains *u u*, with suspended weights, open the cocks in the pipe *k k*, and produce the alternate flow of the gas, and regulate and modify its supply.

In the pipes *g i g* and *h j h* are clacks, or valves, to prevent the return of the water, when the air is admitted into the cylinders.

Mr. Brown claims to be the inventor of the combination above described for effecting a vacuum, *however much* it may be *varied* by the *mechanical means* with which it may be used; and also, the inventor of applying a vacuum produced by the *combustion* of inflammable gas, to raising water, and to the production of motion in machinery by the pressure of the atmosphere.

Specification of a patent granted to Thomas Howard, for an engine to be set in motion by the vapour of alcohol, ether, or other volatile liquids.

I ERECT two metal cylinders (A B, drawing No. 1,) made firm and secure by any of the ordinary methods. These cylinders communicate with each other at the lower part, by a horizontal tube, or smaller cylinder, or otherwise, so as to form a free passage at C, from one to the other. Then such a quantity of fixed oil, mercury, or other fluid, or substance becoming fluid, but not evaporating at the degree of heat to which it will be there exposed, is introduced into these cylinders, as will fill the base of the one, the intermediate passage, and nearly the whole of the other cylinder, to serve as a medium of heat necessary for generating the vapour for working the engine. Within one cylinder B, is placed a piston, exposed above to the pressure of the atmosphere, and having a rod and stuffing, in the usual manner. In the other cylinder A, is placed a thin metallic dish, floating freely upon the oil, or other fluid before mentioned. This latter cylinder has a top fastened down quite air-tight, through the centre of which top, is brought a tube E, proceeding from the condenser (hereinafter described,) the lower end of which tube within the cylinder, terminates in a nosle pierced with many small holes. This tube is passed through a piece of cork, wood, or other imperfect conductor of heat, fixed into the top of the cylinder with a ring

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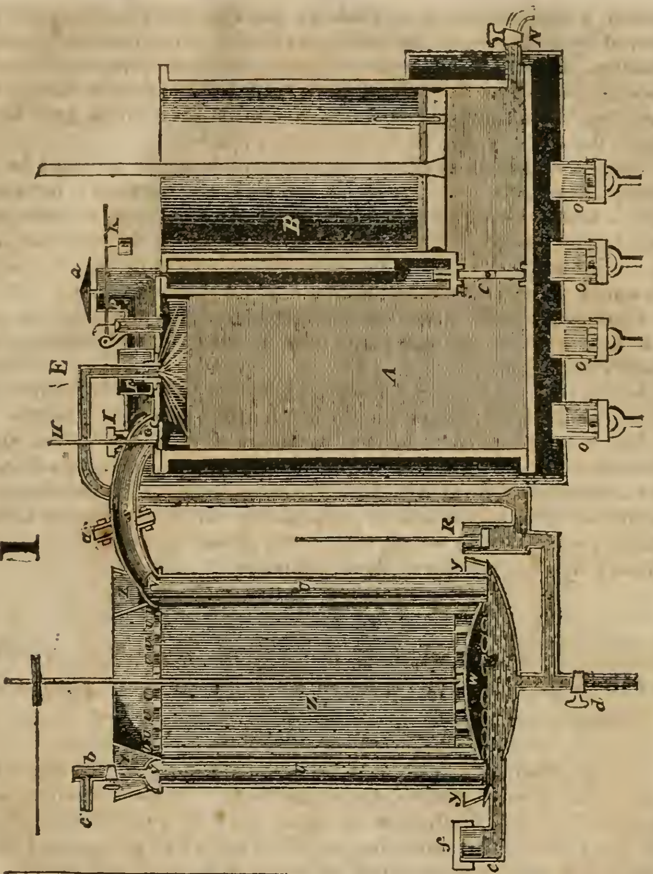

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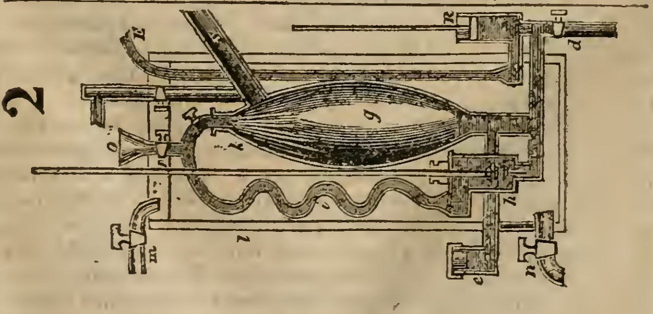
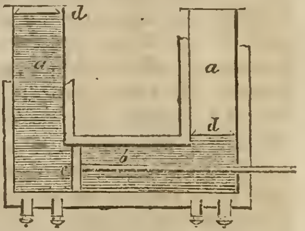


screwed down above it, in which the tube is made secure by a small screw F, in order that all these parts may be air-tight. In the top of the cylinder A, is an oblong orifice, closed by a valve G, of the like form, which opens inwards by a rod H, striking the valve near one end with the advantage of a lever (as a door,) at which end is a small hollow, for the purpose of receiving the rod; at the other end, the valve is confined to its seat by a crane-neck spring, bending over, above it (as in the drawing No. 1, near G:) the rod is entirely detached from the valve, so that the rod has the power only to open the valve; the advantage of which is, that any accidental irregularity in the motion of the rod, will not derange the valve itself. The valve-rod passes through an air-tight stuffing box I, in the usual manner. A safety valve K is placed on the top of the cylinder A. There is an orifice through the piston, into which is fitted a plug, or stopper, by means of which the height of the oil, or other fluid, hereinbefore described, above the piston (which should always be kept a little above the piston,) may be regulated when necessary. The oil, or other fluid, may at any time when required, be withdrawn from the cylinders by a cock, N, near the bottom, and may be again introduced by the top of the piston cylinder through the orifice in the piston. The degree of heat necessary for the purpose of working my Vapour Engine, is obtained by means of a sufficient number of lamps, *o*, *o*, *o*, *o*, on the principle of the Argand lamp, and on a large scale, when required. These lamps are supplied with oil, or other inflammable liquid, or gas, and placed below the cylinders, and the chimnies of which lamps are passed into, and through, a thin metallic or other covering, which covering is carried round both the cylinders (except the upper part of the piston cylinder,) at a small distance from the cylinders, so as to confine and carry the heated air entirely round them. The lamp chimnies should be made of metal, with a hole therein, covered with talc, through which the flame may be seen, for the purpose of regulation. There is a tube or chimney, P, at the top of the last mentioned covering, which tube may be more or less closed by a top or register, Q, the better to regulate the heat of the air within the covering. By means of a small forcing pump, R, which is set in motion, and the length of its stroke regulated by any of the ordinary methods in use, in the steam engine, the tube E, which enters the top of the vapour cylinder, is supplied from the condenser with the liquid, which is afterwards to be converted into vapour, within the cylinder A. The liquid to be employed may be either alcohol, ether, essential oil, or other liquid which evaporates more rapidly, and at a lower temperature than water. I do not, however, confine myself to any particular liquid or liquids, for even water may be used if the heat be sufficiently raised. The degree of heat to which it is proper to raise the oil, or other fluid medium within the cylinders, must be varied according to the nature of the liquid to be evaporated, and to the extent of power required. In order readily to ascertain, and be enabled to regulate correctly the degree of heat within the cylinder, a thermometer is attached to any convenient part, with its bulb passed through the cylinder into the oil or other fluid medium. From the nosle of the tube E, above described, a sufficient quantity of the liquid before mentioned is thrown by the action of the forcing pump, R, not gradually, but quickly, and at once, upon the dish, which being previously heated by the oil (or other fluid medium,) on which it floats, quickly converts the liquid thrown on it into vapour, which vapour receives an increase of expansive power by the heat of the cylinder, and pressing upon the oil (or other fluid medium,) and dish floating thereon, forces the oil through the horizontal passage C, into the piston cylinder, and raises the piston to its highest point of elevation. The valve G in the vapour cylinder being now opened, the vapour escapes by a tube S, into a separate vessel Z, (as in the steam engine of Watt,) and is there condensed; the piston then returns by the pressure of the atmosphere, and the dish is carried again to the top of the vapour cylinder. The valve G is now closed, and a fresh portion of liquid is thrown by the forcing pump upon the dish, to be converted into vapour, and the operation is repeated as before. The dish is not absolutely necessary, as the liquid may be thrown upon the oil (or other fluid medium;) but I prefer a dish, which should be made of copper, with a flat bottom, the internal surface of which should not be polished. A sliding valve *o*, is placed across the horizontal tube, or passage, between the two cylinders, so as, occasionally, either entirely or partially, to close the passage from one cylinder to the other, by means of which the motion of the engine may be easily regulated or stopped. In the top of the cylinder A, is fixed a tube S, by which the vapour is conveyed from the cylinder to be condensed; and this tube should be divided, and a ring of cork, wood, or other imperfect conductor of heat *a*, should be placed between the two parts, which should then be screwed up together, air-tight. By means of this arrangement, the transmission of the heat from the cylinder to the condenser is interrupted. The other end of the tube is inserted into, or communicates with, a circular tube or hollow ring, V V, into which a number of smaller tubes, marked severally U, made of copper or other metal, as thin as the required strength will permit, are fixed and arranged in a circle. These smaller tubes are also inserted into another vessel below, W, which forms a reservoir for the vapour when condensed. The liquid formed by the condensed vapour may, by means of a pipe with a cock *d* placed in the bottom of the vessel, be withdrawn when required. The outer and upper part of the condenser has upon it a circular basin or open vessel X, into which water is thrown by a pump or otherwise, as may be convenient. The smaller tubes severally marked U, are each wrapped round and covered on their external surface with flannel, or other porous substance of the like nature, which is carried over into the upper ring or basin X, from whence, being previously wetted, the water is absorbed, and the flannel or other porous substance used, acting like a syphon, conducts it down the outside of these tubes into a vessel Y below them, from which it may be allowed to run off, or be pumped again into the upper vessel X, if required. Within the hollow circle formed by these smaller tubes, severally marked U, is a machine upon the principle of a fan, kept in rapid motion by the engine or otherwise. By this means a continued stream of air is thrown upon the wet flannel, or other porous substance, and the heat is consequently thereby more quickly withdrawn from the condenser. Previously to setting the engine to work, it is necessary to withdraw the air from the condenser and vapour cylinder, which is done by means of an exhausting pump or syringe applied at *c*, to a pipe with a stop-cock *b*, fixed on the top of the condenser. The liquid to be converted into vapour for working the engine, is introduced into the vessel or reservoir at the bottom of the condenser, through a tube *e*, closed by a screw cap *f*. From this vessel or reservoir (the fluid in the cylinder having been first heated,) the liquid is thrown into the cylinder A by the forcing pump R, as before described. A mercurial gauge may be fixed in the usual manner to any part of the condenser, in order to show the degree of exhaustion within. This method of producing condensation, consists in exposing the vapour or elastic fluid to be condensed, to a large surface of metal, surrounded or covered with flannel, or some other porous substance, continually absorbing water, and at the same time acted on by a stream of atmospheric air. And I claim the application of this new method of producing the condensation of the elastic fluids or vapour, as applicable generally, and not as applicable to my engine only. The condensation of the vapour or elastic fluid, may also be effected by injection upon the same principle as in the steam engine, but with the advantage of dispensing with the constant use of an air pump, and effectually preventing the escape of any of the vapour, or liquid. To effect the condensation by injection, a tube S, (drawing No. 2,) conveys the vapour into an oblong vessel *g*, made of copper or other metal, as thin as the pressure will allow. The required quantity of the liquid before mentioned, and to be afterwards thrown into the cylinder, is introduced into the condenser or vessel *g*, by the tube *e* as before, or by a funnel *o* on the top through a stop cock *p*. The forcing pump R, the tube E, to convey the liquid into the cylinder, the pipe and cock *b*, for withdrawing the air, and also the pipe and cock *d*, by which the liquid may at any time be withdrawn, are constructed as in the hereinbefore described condenser, and answer the like purposes. A lifting pump *h* is put in motion by the engine; at the same time the valve in the vapour cylinder (G, in the drawing No. 1,) is opened as hereinbefore described, and the lifting pump withdrawing a quantity of the liquid before mentioned from the bottom of the vessel or condenser *g*, injects it into the top of the same vessel after passing it through a pipe or worm, *i*, the end *k*, of which pipe being pierced with many small holes, the liquid is dispersed throughout the vessel *g*, and condensing the vapour therein, passes with it to the bottom of the vessel. Part of this liquid is again thrown into the cylinder by the forcing pump R, to be converted into vapour as before described, and part of it is again employed to condense the vapour in the manner last before mentioned. In effecting the condensation by injection, the condenser and tubes connected therewith are immersed in a cistern of cold water, a stream of which is continually passing through it, as in the steam engine. The vapour engine hereinbefore described, operates against the pressure of the atmosphere. This may be avoided, and a double action produced by the following alterations: (the Specification then proceeds to describe them.)

Although I prefer the use of lamps upon Argand's principle, in order to obtain the requisite degree of heat, to give motion to my vapour engine; yet, an engine may be so constructed that fuel of any kind may be used. The foregoing are some of the combinations of machinery to which my invention is applicable, but I moreover claim, as my exclusive invention, the application for the purpose of giving motion to machinery, of vapour generated from liquids within the cylinder or other vessel, in which the power operates, the vapour receiving an increase of expansive power by the heat of the said vessel; particularly when the vapour is generated from such liquids as evaporate at a lower temperature than water.

Thos. Howard.

The annexed drawing describes an engine, which operates against the pressure of the atmosphere, and upon which also depends the return or vacuum stroke of the piston. Two methods of avoiding this and producing a double action, are given in the specification, but which are not inserted here. The following diagram presents an outline of a very effectual arrangement. *a a* are the vapour cylinders or vessels (the form of which may be varied;) *b* is the piston cylinder; *c* the piston, working horizontally. The arrangement of the lamps, injecting tubes, &c. is upon the same principle as before. The vapour is alternately generated within, and withdrawn from the two vessels, *a a*, and acts upon the piston through the medium of the oil or other fluid, upon which, or upon the thin copper floats, *d d*, the small quantity of liquid to be evaporated is injected, as before described.



*Remarks by the Patentee.**—I have denominated my invention a "Vapour Engine," because the vapour of certain liquids, other than water, may be advantageously employed, the term steam being more properly applied to an engine which is worked exclusively with the vapour of water.

When the idea first occurred to me of employing, instead of water, liquids which evaporate at a lower temperature, I perceived, immediately, that it would be hopeless to attempt the practice of such a theory upon the present principle of the steam engine; and when I afterwards found that such had actually been attempted with alcohol, I was not surprised that it had proved abortive. To say nothing of the danger of placing a furnace under a boiler containing a large quantity of an inflammable liquid, it would be almost impossible to prevent its escape, which would soon amount to far more than the saving of fuel that would be made upon *that plan.* After making many experiments, it appeared to me that the vapour might, by a new and proper arrangement, be generated within the cylinder itself, and thus do away with the necessity of a separate boiler or generator of any kind. I ascertained that ether or alcohol would evaporate with sufficient rapidity, and would produce an instantaneous and very great pressure in a closed vessel, if the surface upon which a small quantity was thrown were heated to about 100° above the boiling point of the liquid. In these experiments mercury was employed as a medium upon which to evaporate the liquid. The following table will explain the system.

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* Of these remarks we have abstracted a small part only, and that, not so much with the design of showing the views of the patentee, as of exhibiting the principle upon which the anticipated advantages of vapour engines generally is founded. Editor.

Ether at the Temperature	Alcohol at the Temperature	Water at the Temperature	Force of Vapour in Atmospheres	Cubic Inches of Vapour of Atmospheric Pressure produced from 1 cub. inch of Liquid	
100°	175°	212°	1	1800	Pressure in Vacuo at the Temperature 60° in inches of Mercury. Ether 12 in. Alcohol 2 in. Water ½ in.
140	215	252	2	3600	
180	255	292	4	7200	
220	295	332	8	14400	
260	335	372	16	28800	
300	375	412	32	57600*	

and so on in proportion, for every additional 40° of heat, but gradually decreasing in effect as the temperature advances. The calculations are given only as an approximation sufficiently correct to illustrate the theory.

Suppose it be required to work an engine with ether, having a cylinder or vapour vessel or vessels, 20 inches in diameter and 30 inches in length, and with a pressure upon the piston, or (which is the same in effect) upon the intermediate fluid, of eight atmospheres, and which would be a very powerful engine. Such a vessel as that above described will contain about 10,000 cubic inches. This will require the evaporation of about 5½, say 6, cubic inches of ether at 220°, and as 6 cubic inches contain nearly 1600 grains or drops of liquid, 5 drops must be evaporated from each square inch, since the diameter of the vessel, 20 inches, presents a surface of about 320 square inches. Five drops of ether upon a square inch of surface heated to 220°, will evaporate with a rapidity sufficient to produce a motion equal at least to the condensing steam engine. By decreasing the heat or the quantity of liquid injected, the effect will be decreased in proportion, so that the motion and power of the engine may be governed with great exactness. If the quantity of liquid injected be decreased, and not the heat, the power (pressure) only will be decreased: the motion, so far as depends upon the quickness of evaporation, may even be increased. The relative proportion between the motion and power, also, depends upon that between the surface of the piston and the surface of the intermediate fluid, which receives the pressure of the vapour. It is not necessary at present to enter fully into this part of the subject; there must be, of course, a certain modification with regard to the temperature and the quantity of liquid injected, which must be found, by practice, to produce the most advantageous result; this will vary according to the purpose for which the engine is designed, and from other circumstances.

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* In a subsequent communication, the patentee states that this fifth column is incorrect; the scientific reader will make the same remark upon the fourth, in which, the force of vapour is made to double with every addition of 40° of heat; this is only an approximation. EDITOR.

Alcohol will furnish the same results as ether, if the temperature be raised 75° higher; and upon the whole, this liquid may perhaps be preferable, particularly as it may be more readily and effectually condensed.

Water will also give the same expansive power at 112° higher than ether, or 37° higher than alcohol; but the motion of the engine would be comparatively slow at this degree of heat, and, therefore, independently of the necessary increase of temperature, the greater quantity of latent caloric absorbed by its vapour, and other circumstances, the same effect can only be produced from this liquid by a greater consumption of fuel.

It is scarcely necessary for me to point out to those who are conversant with these subjects, the advantages which will result from the employment of the vapour engine, particularly in navigation. It is proper, however, that I should take some notice of them. The most apparent are,—the very small consumption of fuel; the absence of all nuisance from smoke, and of a chimney flue, when lamps are made use of; the trifling space occupied by the quantity of oil, or other material, necessary, even for the *longest* voyage, compared with that at present required in steam vessels for the stowage of coal; the small space occupied by an engine of the greatest power; its perfect safety, portability, and moderate expense of construction.

Account of a patent granted to ARNOLD BUFFUM, *late of Massachusetts, but now residing in the City of London, (being one of the people called Quakers,) Hat Manufacturer, in consequence of communications made to him by certain foreigners residing abroad, and discoveries made by himself, for an Invention of certain Improvements in the process of Making, or Manufacturing, and Dying Hats.*

THE patentee states, that there are four principal objects accomplished by this invention; 1st, facilities in the process of dying hats; 2nd, the production of a more perfect colour; 3d, the prevention of any of the damages to which hats are subject in the common mode of dying; 4th, the accomplishment of the dying process in a much shorter time than by the usual methods, and of consequence lessening the deleterious effects of the dying materials upon the hat itself, which frequently does great injury.

It is considered by the patentee, that the process of dying hats will be greatly facilitated, and the colour improved, by occasionally removing the hats from the dye vat or copper, and exposing them to the oxygen of the atmosphere; and it is also observed, that the colour of the hats suffers injury by touching the sides of the vat or copper in dying, and in being pressed against each other. In order, therefore, to remove the hats occasionally from the dye copper with convenience and facility, and at the same time prevent their being brought in contact while immersed in the dying liquor, an apparatus is proposed by which these objects may both be effected.

One method of constructing the apparatus is to make a vat, or dye-kettle in the form of a half cylinder, with flat ends; within this, a hollow frame work wheel is made to revolve, like a grindstone in its trough; one half of this wheel, when placed upon the kettle, will be immersed in the dying liquor, and the other half exposed to the air. Within the rim of this wide wheel there are pegs upon which the hats to be dyed are placed, so that as it revolves they are successively passed into, and out of the dying liquor.

This wheel may either be kept revolving with a very slow motion, by gear connecting its axle to any moving power, or it may be turned half round at intervals of about ten minutes apart; by which means, the hats hung upon the pegs will be alternately immersed for the space of ten minutes in the dying liquor, and then for the same space exposed to the atmospheric air.

In this way it is considered that the process of dying hats may be greatly facilitated and improved, as the occasional transition from the dye vat into the air, and from the air again into the dye, will enable the oxygen of the atmosphere to strike the dye more perfectly and expeditiously into the materials of which the hat is composed, than by a continued immersion in the dye for a much greater length of time.

A variation in the mode of performing this process, is suggested, and the apparatus proposed to be employed, is a square vat or vessel to contain the dying liquor; and a frame or rack having a number of pegs placed in it for hanging the hats upon, which are about to be dyed, in a similar manner to the wheel above described. This frame or rack is suspended by cords from a crane, and may in that way be lowered down with the hats into the vat, or drawn up and exposed to the atmosphere; which changes are recommended to be made every ten minutes until the dying is completed.

[*Newton's Journal.*

Account of a patent granted to JOHN ROTHWELL, *Tape Manufacturer, for his Invention of an Improved Heald or Harness for Weaving.*

THE object of the patentee, in the construction of these improved healds, or harness for guiding the warp threads in a loom, appears to be to afford greater space for the passage of the warp threads, as the sheeds open, or pass each other, than is afforded in the ordinary kind of healds employed for the weaving of fine fabrics.

It is proposed to make the loops of the healds double, that is, passing over the shafts at top and bottom, and meeting both at the back and front; and also that the headles shall be formed by long and short loops alternately; that is, one of the upper loops being long, and the lower loop connected to it, short, the next upper loop is to be short, and its lower loop long, and so on alternately. By these means, the knots of the one series of loops, will be a little distance above the knots of the other series of loops, and the warp threads passed between these knots will be depressed as the heald descends, by the upper series of knots, and raised as the heald ascends by the lower series of knots for the passage of the shuttle between them; the threads being thereby enabled to pass each other with greater freedom, and of consequence less friction, the space for the warp being open in the middle.

Healds are usually made of woollen or hempen cord, twisted very hard, and called heald or headle yard; these improved healds may be made of the same material, or they may be fine wires, which in some cases would perhaps be preferable. [*Ib.*

Account of a patent granted to John Frederick Smith, *of Dunstan Hill, Chesterfield, in the County of Derby, Esq. for his Invention of Improvements in the process of Drawing, Roving, Spinning, and Doubling Wool, Cotton, and other fibrous substances.*

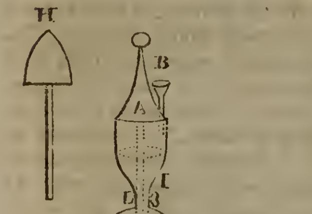
The patentee has discovered that it is very desirable, in the processes of roving, spinning, and doubling of wool, cotton, and other fibrous substances, to prevent, as much as possible, the fibres of the material being disturbed, or drawn out of the positions in which they were first placed by the carding engine; and in consequence of this discovery, it is directed that in all the future operations to which the fibrous materials may be subjected, whether of roving, spinning, or doubling, that the fibres should be carried through the several engines in the same direction, that is, always beginning with the end which was first delivered, or wound in the preceding machine; and this is the invention of improvements in the processes of roving, &c. which constitutes the subject of this patent.

The instructions of the patentee, in carrying this invention into effect are, that the operator should observe carefully which end of the sliver first came from the carding engine, and of consequence to introduce that end first into the roving machine, and continue to observe the same direction of the fibres in all the subsequent stages of operations, that is, spinning, &c. And here it is to be observed, that if the rovings are conducted into cans, which is sometimes the case, that then, cans with their two ends open are to be used, because by the employment of these cans, the ends of the rovings which were first delivered, may be readily got at. And when the rovings are to be wound upon bobbins, it is desirable to employ the new invented bobbins with moveable ends, for the capability which those bobbins possess of enabling the cop to be slidden off its barrel, will likewise afford the means of getting at the interior of the cop, for the purpose of finding the end of the roving first wound upon the bobbin, that the spinning may commence from that end.

This mode of proceeding, the patentee considers, cannot fail of producing a much more smooth and even yarn, or thread, than could be effected by the ordinary mode of roving and spinning. [*Ib.*

Self-generating Gas Lamp.

(From the Edinburgh Philosophical Journal.)



The oil vessel of this lamp is represented at A. B is the tube by which the oil is admitted; C is the generator; D is a hollow vessel, where the heat from the burners F, underneath, is collected; the dotted lines are projecting ridges on it, within the generator, to prevent the oil running down and collecting at the bottom of the generator. E is a circular piece of iron, to collect and retain the heat. G are tubes to conduct the gas from C to F. L is a tube to supply the vacancy in A with gas, as the oil is discharged into C. H is a metal heater to fit into D.

To use the lamp, fill A partially with oil, alcohol, or any fluid from which gas is produced, and having made the metal-heater H red-hot, place it in the bulb D; after it has continued in it a minute or two, turn the stop cock I, allowing the fluid to drop slowly on the heated bulb D, below, by which it will be converted into gas. When it is found to escape in sufficient quantities from the burners at F, set it on fire, remove the heater, and a beautiful bright flame will be supported by its own heat as long as there is oil in A.

It may be found necessary to replace the first heater by a second, when the lamp is used for the first time, to expel more effectually the atmospheric air from the generator and tubes. The heat collected in D will be found sufficient to generate gas to a third burner, if required, as it is an indisputable fact, that most bodies, in a state of combustion, give out much more heat than is requisite to support an equal body of flame, and this is quite evident, by fire spreading so rapidly in all combustible substances, if not checked.

ON GILDING.

GILDING UPON BRONZE. *Continued from p. 392, vol. 4.*

7th. *On giving the colour of Or Moulu.*—When it is desired to give to gilt articles the colour of *or moulu*, the scratch brush is used less freely than usual; the work is then *restored*, by heating it more highly than when it is to be left *mat*, and it is afterwards allowed to cool a little. The *or moulu* colouring, is a mixture of blood stone, alum, and common salt; these are diluted with vinegar, and applied with a pencil, over the surface of the gilding, taking care to avoid the parts to be burnished: the piece is then placed upon lighted charcoal, which may be rendered more active by gently blowing it; the heating is continued until the work begins to assume a black colour. The piece should be sufficiently hot to cause water sprinkled upon it to be rapidly converted into vapour. The article is then withdrawn from the fire, and plunged into cold water; it is to be well washed, and the orange colour which the gilding presents, is equalized by rubbing the piece with a pencil dipped in vinegar, if the surface be smooth, or with weak nitric acid, if it has been ornamented with the graver, or the chisel. In either case, the article is to be well washed, and dried at a moderate fire.

8th. *On producing the colour of red gold.*—When the gilding is to receive the colour which distinguishes the triple alloy of gold, silver, and copper, usually employed in the manufacture of jewellery, this is effected by the subjoined operation.

The work, when sufficiently gilt, is, whilst warm from the fire, to have a fine iron wire attached to it, and is immersed in, or covered with, the composition known under the name of *gilding wax;* this is made of yellow wax, red ochre, verdigris and alum: when thus prepared, it is heated strongly over a charcoal fire, and the inflammation of this covering of wax is promoted, by throwing some small pieces of the same substance into the fire: the work must be turned about on the fire so as to heat, and burn off the wax on every part at the same time; when the whole of the gilding wax is burned off, and the flaming has ceased, the piece is to be plunged into water and well washed and scratch brushed; using pure vinegar in the operation. If the colour is not good, and the tint equal throughout, the piece should be covered with a solution of verdigris in vinegar, dried on a gentle fire, again washed in water, and scratch brushed with vinegar; should the colour be too dark, a little weak nitric acid, may be used, instead of the vinegar. After being coloured, the work is to be washed, burnished, again washed, wiped with soft linen, and dried by a gentle heat.

In performing the foregoing process, the utmost care is necessary to avoid the deleterious effects of the mercurial, and other fumes. Great numbers have fallen early victims to this business, or after a few years devoted to it, have been rendered impotent for the remainder of their lives. To obviate these fatal effects, M. D'Arcet has devised such arrangements in the forges and furnaces used in the large manufactories, as cause them completely to carry off the vapours, without exposing the workmen to their action. In the *Dictionnaire Technologique*, there are drawings of the plan and elevation of such an establishment, where the business is to be carried on very extensively; these we have not thought it necessary to give, as, with us, gilding is only an occasional business. It is of high importance, however, to avoid the mercurial vapour, even in a single operation, especially when large pieces are to be gilt. For this purpose the forge chimney should have a strong draft, the air for which may be supplied by tubes leading to the outside of the building, which may be regulated at pleasure, whilst that from doors and windows is irregular, and if admitted in sufficient quantity, would frequently render the workshops uncomfortable.

M. D'Arcet advises the gilders not to touch the mercury with the naked hands, when it can be avoided; and to wear gloves of leather, or of bladder, or, which is best, of waxed silk. Before leaving the workshop, and especially before eating, the hands and the mouth should be carefully washed with warm water, and afterwards with soap and water, to completely remove the amalgam, and the nitric solution.

GILDING ON IRON AND POLISHED STEEL.

Guyton de Morveau has pointed out a very easy manner of gilding, durably, upon iron and steel, after they have been polished. The following is his process. Gold, rolled very thin, is dissolved to saturation in nitro-muriatic acid *(aqua regia;)* upon this is poured a quantity of ether, equal in volume to the quantity of acid employed. The whole should be placed in a flask of double the capacity of the two liquids; it is to be well stopped and strongly shaken, when the ether will take up the gold, which the acid had dissolved, and will be found swimming upon it, exhibiting a beautiful yellow colour. This liquid is to be separated from the acid by means of a funnel with a very small opening; the acid being the heaviest may be allowed to flow out first, and at the instant the ether begins to follow it, the receiving vessel must be changed. The liquid must be carefully stopped, and preserved for use.

When any piece of iron or steel is to be gilt, it must be first well polished, and slightly warmed, the auriferous ether may then be applied with a pencil, the ether will quickly evaporate, and leave the gold, which may be firmly fixed with a burnisher.

GILDING BY HEAT, WITH LEAF GOLD.

The metal intended to be gilt, whether iron, copper, or brass, is first made smooth with a scraper, and burnished. It is then placed on the fire, and heated, until, if it be iron, or steel, it acquires a blue colour; and to an equal degree, if it be copper or brass; a piece of gold leaf is then applied on the part to be gilt, and gently rubbed down with the burnisher; the work is again placed upon a moderate fire, to restore it to the former temperature. Several coats of leaf may be thus applied, successively; each coat is formed of a single leaf for ordinary work, and of two leaves for finer articles. The work is placed on the fire, and the gold burnished on for each coat, and the burnishing is continued on the last, until the metal is cold.

COLD GILDING ON METAL.

Dissolve about 60 grains of fine gold, rolled very thin, and ten or twelve of pure copper, in two ounces of nitro-muriatic acid (*aqua regia.*) When the solution is complete, it is to be poured, drop by drop, upon clean linen rags, sufficient in bulk to absorb the whole of the liquid; these are to be dried, and then placed upon a china plate, and reduced to cinders, taking care in lighting them not to use a sulphur match. These cinders, of course, contain the gold in fine powder.

When a piece of metal is to be gilt with this powder, it must be prepared by being left with a clean surface, such as is given by a fine stone, or charcoal; a small pad of linen is to be slightly moistened, and dipped into the box containing the powder; with this the work is to be rubbed, until its surface is sufficiently covered with gold. Large articles are afterwards burnished with blood stone burnishers, and smaller ones with those of steel, using soap suds, to prevent scratching, or stripping the gold.

GILDING THE EDGES OF BOOKS.

Equal parts of Armenian bole, and of sugar candy, are to be well rubbed together in a dry state; a portion of well beaten white of egg is then added, and the whole carefully incorporated. The book to be gilt is placed in the cutting press, its edges smoothly cut, and polished; a light coat of white of egg is then passed over it, and allowed to dry, after which the same is to be done with the composition above described; when this latter is perfectly dry, it is to be rubbed smooth and polished; it is then ready to receive the gold. To apply this, the prepared edges of the leaves are to be moistened by means of a hair pencil, dipped in clean water, and the gold immediately laid on. The burnishing is effected by rubbing the gold, when dry, with a dog's tooth, or agate burnisher.

GILDING ON THE COVERS OF BOOKS.

When the binding of books is completed, a portion of well beaten white of egg is passed over those parts which are to be gilt, in a similar way to that described in the preceding article; this operation, however, may be dispensed with: the gold is then laid on, and fixed in its place by what are called *binders' tools*, which are made of brass, and have the intended ornaments engraved upon them, in relief. These tools are to be heated and pressed upon the leaf, and wherever they have touched, the gold will adhere firmly. The superfluous gold is then rubbed off with a piece of cotton wool, which is to be preserved, and burnt, to obtain the gold from it.

Observations on the use of Seneca Oil, and particularly on its employment for the purpose of producing illuminating gas, in the city of Pittsburgh.

[Extracted from a letter to the Editors of the Pittsburgh Gazette.]

* * * "I SEE that the corporation has, at last, determined to light the city: it is a very sensible determination, for indeed few places needed it more. I fear that lighting with gas will be found troublesome and expensive, in spite of the vast supply and cheapness of the coal. But I will tell you what is the cheapest, best, and most economical light you can use: it is what is called, in the west, Seneca oil; which is Petroleum, with some peculiar characteristics which distinguish it from that which is found in various other parts of the world, in the Cornish and Devonshire mines, in England, for example.

"It would be superfluous in me to describe this oil to you; to tell you how it is found throughout all the coal formation west of the mountains, in springs; in the rivulets which flow out of coal mines; in certain clays or earths, from which it is separated, as it was formerly, to considerable amount, on Oil Creek, by manipulating it in water; and also floating on all, or nearly all, the salt wells. This substance, were there a ready market for it, might be supplied at your very doors, to an almost unlimited extent. At present it is almost valueless, being used only as an ingredient in what is called "British Oil," and as a horse medicine, (in which, by the bye, it is very useful.) The price of it is very low, because a few barrels glut the demand of the apothecaries; but if the city would take a large quantity, or if it were brought into general use otherwise, I believe it could be supplied at 25 cents per gallon. This may be said to be a very indifferent price for the article, unless it existed in great quantities in particular places—that it would not be worth the trouble of collecting; and of course, being neglected, the price would rise for want of a supply, and then such quantities would be brought forward as to injure the dealers, a thing always to be deprecated in a well regulated country. Few things, however, offer so direct a proof of the doctrine, in political economy, that *value* is the effect of labour—a doctrine which I do not confess to be true in every instance, nevertheless. The substance in question is diffused throughout the country, and this will make it abundant in the market; but wherever it is found, it rises and accumulates slowly, and what is accumulated can be collected in a few minutes, with scarcely any labour, except where it is procured from the peculiar clay banks in which it is found. The salt wells may be cleared of what floats, by letting a blanket down every quarter of an hour, and this will also apply to the springs where it is discovered. It is like honey and beeswax, of which few families have large quantities, but so many persons produce them that there is always a good and cheap supply in the market. Such articles, when extensively used in a city, and obtained from the surrounding country, beget an intercourse which is mutually beneficial. It is manifestly desirable for a city to awaken to its interest by encouraging such a new object of trade, which, whilst it increases the circulation of money, will enable the country people to purchase more largely from the stores in town. In a word, it is the true policy of a city to enrich the surrounding country; and that city flourishes most, whose vicinage is the most prosperous.

"I need not argue further, to show the advantage of using Seneca Oil to light Pittsburgh, if it is applicable to the purpose. The proof of its applicability is only to be procured in the old and sure way—TRY IT. Let any one who doubts that it is a perfectly good oil for lamps, send to the apothecary's for half a pint, and burn it one night, in a lamp of any kind, precisely as fish or spermaceti oils are burned, observing only that to avoid smoke, it is necessary the length of the wick should be diminished. I have tried it, and found it succeed perfectly; but I have not tried it clarified; and there is no reason why it should not be clarified as well as any other oil, (and then it will burn as free from smoke,) by filtering or precipitating the gross particles contained in what is now brought to market. I am not chemist enough to give a disquisition on its component parts, but combustion shows that it contains more inflammable matter than animal oils.*

"Fish oil, to a considerable amount, is now taken over the mountains, for which you have to pay money, or money's worth: but if this oil gets into general use, I should not be surprised, if in a few years, it becomes an object of very large transportation to the east; thus affording a new article, to bring money to you. I proposed last winter, to one of the directors of the light-houses, to try this oil for those establishments; but, as yet, there is not a sufficient quantity on the sea-board, to authorize a large experiment of the sort. I believe it applicable to most of the arts in which oil is used, and have now employed a capable person to begin some experiments on it. Some of these applications are of my own invention, and if they answer my expectations, I think I shall patent them, which will be a slight recompense for introducing a new means of wealth to an extensive region. If no other good is produced by this communication, I hope it will have the effect of attracting attention, and causing experiments on a substance so abundant, which now runs to utter waste.

"Let me add another idea, which, I am conscious, will at first view be thought very visionary; but I say, *only try it;* the experiment will cost nothing. Many of the salt wells are filled, from the surface of the water to the mouth of the well, with inflammable gas: let a tight barrel with the head out, be let down, perpendicularly, into such a well, and after having remained some minutes, as the gas is heavier than the atmosphere, it will displace the latter, and fill the barrel: then let a wet blanket down, to cover the head of the barrel, and after it is drawn up, uncover a small space and tilt the barrel; then let a lighted candle, at the end of a long pole, be placed at the aperture: if the barrel be full of gas it will take fire, and probably explode. If this experiment succeed, the induction is clear. Barrels of gas, for the use of the city, if you choose to light with gas, will become as constant an article of commerce from the salt works as salt is now. These barrels may be emptied into a grand air-tight receptacle, easily contrived, and thence distributed, exactly as gas made from coal.—Here, then, is another source of income to the country. Indeed, Providence has been so bountiful to the whole west, that wealth seems to court you on every hand. Should the experiment of filling barrels with gas at the salt works, not answer, it will be very desirable that the city should cause an essay to be made on the production of gas from the Seneca Oil, which abounds with the materials for its production. It is well known that the use of animal oil to produce gas, has been extensive in England, after its superiority over gas from coal had been tested; but the high price of those oils there will probably prevent the general adoption of them for this purpose. Some writers, however, contend that they will produce gas at a cheaper rate than coal, in spite of the cost of them. If Seneca oil will supply more gas than animal oils, which I do not doubt; and if it can be procured at 25 cents per gallon, a fair trial of it in this way, would, assuredly, be demanded by common prudence.

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* It has been recently discovered by Mr. Keller, governor of the mines of Trockawitz, in Galicia, that naphtha gives a light which compared with that from tallow, is as 1000: 935.—See *Repertory of Arts and Sciences.*

"It seems to me, that indispensable as lighting the city is to the comfort and safety of the inhabitants, the corporation ought to deliberate maturely on the plan it will adopt, because any future alteration will be expensive, and because the lighting of a town is among the heaviest of its charges.

"You will excuse my troubling you so much at length, as it is only a fresh proof of the interest I constantly feel in every thing which concerns a city and a country where I have been kindly treated, and of my desire to repay that kindness with my feeble exertions. Were I to do them tenfold the good I ever expect will be in my power, I should still think myself in arrear." * * * Mucius Scævola.

Remarks by the Editor.—We have inserted the foregoing observations, because we apprehend that a portion of the information which they contain will be new to most of our readers, as it was to us; we refer particularly to the large quantity of Petroleum which can be obtained in the vicinity of Pittsburgh. That this material will afford an illuminating gas, by destructive distillation, is undoubtedly true; but we apprehend that it will not be superior to that obtained from the bituminous coal in its vicinity, and are convinced that it would be inferior to the gas from oil. In a manufacturing town, like Pittsburgh, the coke from a coal gas establishment, will be a very valuable article, and will, of course, greatly diminish the expense of carrying on the works. In Baltimore, where the gas is made from coal, the gas company have been unable to sell their coke, excepting on very disadvantageous terms; and we have but little doubt, that were it in their power to change the system, without serious loss, they would there adopt the use of oil, which possesses several advantages over coal; among these, are, the trifling residuum left from the distillation; the diminution in the size of the retorts, gasometers, and pipes, which, from the great illuminating power of oil gas, may be of less than one-half the dimensions of those required when coal is employed; the avoiding the necessity of using lime to purify the gas, a process both troublesome and expensive; the comparative freedom of oil gas, from that offensive smell which predominates in coal gas, from the presence of sulphuretted hydrogen, which is but partially separated, by the purifying process, in the way it is actually conducted.

Those persons who have visited London, or Baltimore, and who have had an opportunity of comparing the odour emitted by the coal gas in those places, with that from the oil gas in New York, must be sensible of the very great difference between the two. At coal gas works, they tell you that this is accidental, but this information affords little consolation, as it is the accident of every day. We perceive that we are unwittingly travelling from Pittsburgh, to which we at first intended to have confined our remarks, leaving their application to other cities, to the understanding of the reader; we have taken a glance at London, Baltimore, and New York; and although we have not mentioned, we have thought of Philadelphia, and whilst we hope to see the brilliant gas light, illuminating our streets and stores, we also hope that they will never be polluted by the nuisance of coal gas. In Pittsburgh, where bituminous coal is generally used as fuel, the force of this objection is greatly diminished, and its cheapness will probably insure it a preference to all other substances. The high price of oil, in England, has not even there prevented the extensive use of it in gas works, and on our own sea-board, it can be afforded at a less price than that assigned to Seneca oil by the writer of the observations. It has been purchased in New York, by the gas company, at less than 25 cents per gallon, and, it is said, can generally be so purchased, in the large way.

The suggestions made respecting the obtaining of a combustible gas from the salt wells, which are generally filled with it, are, we believe, founded in an imperfect knowledge of the chemical constitution of the gases so produced; but as this is a subject with which the writer does not pretend to be intimate, the suggestion was perfectly natural; this gas affords an extremely feeble flame, and were it possible to transport it to the city, without incurring an expense manyfold greater than that of generating gas from coal, or from oil, it would scarcely make darkness visible. All the species of carburetted hydrogen, are lighter than atmospheric air, and if that contained in the wells is heavier, this must arise from its being contaminated with carbonic acid, (fixed air) which would still decrease its illuminating power.

On Speculums for Reflecting Telescopes. By the Editor.

The casting, grinding and polishing the speculums for reflecting telescopes, are mechanical operations of very great nicety, requiring a much larger portion of care and skill, than the grinding and polishing of glass lenses. There are but few manufacturers in England, whose reflecting telescopes are in much repute, although they are to be found at most of the Philosophical Instrument makers; a telescope of this kind may appear at first to be good, but in a short space of time may afford a very indistinct view of such objects as are seen through it, in consequence of the tarnishing of the metallic reflectors. Different workmen have used different mixtures, although they almost uniformly consist, principally, of a mixture of tin and copper, to which other ingredients are added, and in the proportions of which variations are made. A good speculum must be perfectly compact, so that no pores can be discovered in it by the microscope; it must be sufficiently hard to take a fine polish, and to protect it from being readily scratched; it must not be liable to tarnish in the air, as this will effectually destroy its usefulness, and it must possess the property of reflecting nearly all the light which falls upon it. We have assisted in the operations of grinding and polishing, and intend hereafter to give such directions, as shall enable those who have patience, and skill, to perform them themselves. But few attempts of the kind have been made in this country, the demand for such telescopes having been but small. The first reflecting telescope made in the United States, was by the late Jotham Fenton, of New Haven, Connecticut; a man of much mechanical ingenuity, and of untiring patience. He followed the directions given in 'Imison's School of Arts,' and produced a good instrument;—this was about thirty years ago.

We published, in the last number, an article on the grinding and polishing of lenses, and design to give such further information thereon as will render the operation quite familiar. We now commence the republication of the observations on speculums, which originally appeared in the Nautical Almanac, for 1787, and which is still considered as one of the most useful essays upon this subject.

On Casting, Grinding, and Polishing Speculums, for Reflecting Telescopes, Microscopes, &c. By the Rev. John Edwards, B. A.

On the best composition for Reflecting Specula.—I found that thirty-two ounces of copper, with fifteen or sixteen ounces of grain-tin (according to the purity of the copper,) with the addition of a little brass and arsenic, viz.—one ounce of each to the above proportion of copper and tin, will form a metal, capable, when polished in a proper manner, of reflecting much more light than any other metal that has yet been offered to the public. When I say that the proportion of tin, is from fifteen or sixteen, to thirty-two ounces of copper, I would be understood that the proportion of tin will not always be accurately the same, as copper will take more or less tin to saturate it, according to its purity. It might be of use, previously, to purify the copper as much as possible. A very little experience in these matters will enable any one to know when the copper is completely saturated, as the composition will, if broken, appear of a most beautiful, bright and glossy nature, very much resembling the fine face of quicksilver. My method to ascertain that point accurately is to melt thirty-two ounces of copper, and to add to it, when sufficiently fused, fifteen ounces of tin, and to pour the mixture into an ingot mould: then, to a certain known portion of this composition, I add a very small but known portion of tin; and thus, by a few trials, I can easily obtain the point of saturation, and the maximum of perfection. Having then ascertained what portion of tin I added to the above known quantity of the composition, I add the proportional quantity of tin to the whole, when melted a second time. Thus, if I find that I must add a quarter of an ounce of tin to one pound of the composition, so as to obtain the *ne plus ultra* of brilliancy,* then I know that when I shall melt the remainder of the metal a second time, in order to cast the speculum, I must add one of grain tin to four pounds of the composition, made according to the proportion of thirty-two ounces of copper, to fifteen ounces of tin. The arsenic must be added in the second melting, when the speculum is intended to be cast,† as the heat of the mixture in the first melting is so great as to render the most part of the arsenic volatile, and in a great measure prevent its action upon the metals. It is somewhat singular that arsenic, though particularly recommended by Sir Isaac Newton for this purpose, should be hastily thrown aside by the founders, as well as passed over unnoticed by the writers upon this subject. This imprudent disuse I can only attribute to the disagreeable fumes or vapours which arise when it is introduced into the crucible to the melted mixture, which may produce disagreeable effects upon the operator, if proper care is not taken to prevent them from being received into the lungs. All the precaution necessary is to bruise the arsenic coarsely, and introduce it into the crucible with a pair of tongs, having tied it up in a piece of paper; give it then a stir, with a wooden spatula, retaining your breath; avoid it till you can see no more vapours arise from the crucible, when the metal will be ready to be poured into the flasks, to cast the speculum. The great use of arsenic in this composition is to render the metal much more compact and solid, and indeed much more beautiful, as one may experience by comparing the composition with arsenic, with the same composition of copper and tin, without arsenic. In general, I find one ounce of arsenic sufficient for one pound of the metal. A much greater quantity of arsenic may be used without any disadvantage to the beauty or compactness of the metal, but then it is too apt to tarnish if exposed to the air for some time; three-quarters of an ounce, or an ounce of arsenic, to one pound of composition, will not tarnish in the least degree. Indeed, the reason why the metals generally made use of for specula, tarnish, when they are much exposed to the air, is because the quantity of copper in their composition is not nearly saturated, and the oxygen contained in the air, by acting upon it, extracts the copper from the tin, and turns the metal into a dirty or dingy-coloured speculum; and which (besides the loss of light) causes the common reflecting telescopes to show all objects of a dirty red, or yellowish colour. This, however, is not the case in the metals made of the above composition; for as the copper is completely saturated, the air cannot act upon it in the least degree. I must not, however, pass over one caution in the mode, or manner, of melting the composition, and that is, that the copper must be melted first of all, and rendered as fluid as possible; then the brass and silver (if any is employed) must be added, and the whole fluxed with the common black flux, made of two parts of tartar to one of nitre, or by stirring the melted mixture with a wooden spatula of birch, and made as fluid as possible. The tin must now be added, and the whole poured off immediately, after it is once stirred together; for if the mixture is continued on the fire some time after the tin is added to it, it will prove porous afterwards, though it be melted another time with the smallest heat possible. As I ever found this to be the case, I naturally conjectured that the metal would be most solid and free from pores when the tin remained the least time possible in a state of calcination. Experience determined the truth of my conjecture, and I now find that the best method possible to make this composition to the greatest advantage, is to melt the copper as fluid as possible, and flux it with the black flux; to melt the tin in a separate crucible by itself; to take the two crucibles out of the fire, and pour the melted tin into the copper; and stir it instantly with a wooden spatula, and pour the whole immediately into a large quantity of cold water. The sudden chill from the cold water divides the melted mass into an infinite number of small particles, and by that means cools it instantaneously, and consequently prevents the tin from calcining sensibly; and hence I have always found, that in the second melting the composition was entirely free from pores, even although no arsenic had been employed: yet the addition of arsenic ever rendered it more compact, and indeed specifically heavier,* as well as more brilliant and beautiful. On reversing the process, if the tin is put into the bottom of the crucible, and the copper at the top of it, which I have frequently done, the copper will melt with a very little heat; whereas, when copper is put into the crucible by itself, it requires a pretty strong heat to cause it to melt. When I first made use of this method, I imagined I had discovered a very easy one to melt the copper, and consequently I thought I had greatly improved the common method; and as Mr. Mudge ascribed the pores in the metal to the tin being calcined by the great heat of the fluid copper at its first melting, I naturally expected to find the metal, made by the above process, totally free from pores, especially in the second melting, as the heat was considerably less than if the copper had been melted first by itself: however, I always found it full of pores, much more porous than I had ever seen it before. For some time I could not discover the true cause, having no idea that the pores were owing to the tin remaining so long in the fire in a fluid state, and therefore in a state of perpetual calcination. I attributed the porosity of the metals which I made of this composition to a multude of causes, till, thoroughly tired of experiments and conjectures to ascertain the true reason, I was determined to melt the copper first, and the tin afterwards, as I had always done, before I dropped upon this improved method, as I imagined. The result was, the metal was infinitely more compact and much less porous. By melting the copper first, and then adding the tin to it, I soon discovered that the longer the tin remained in the fire, the more porous the metal turned out; and, *vice versa*, the sooner I poured it off, after I had added the tin, the more compact and free from pores it proved. From these observations, I determined to try the effect of adding the tin in a fluid state to the melted copper, and to cool the whole immediately, to prevent, as far as I was able, calcination from taking place. Experience confirmed my conjectures, and I soon found that by pouring the whole melted mass the instant they were mixed and stirred together into cool water, the metal always proved in the second melting solid, and much more compact, beautiful, and white, than I had ever before seen it by any other process. One thing I cannot pass over, as it affords a clear proof of the use of arsenic in rendering the metal much more solid and compact, and consequently more free from pores than if no arsenic had been used in the composition. Whenever I made the composition by melting the copper and tin together, the metal was always porous as I observed before; however frequently I melted it afterwards, and though I gave it no more heat than was barely necessary to melt it, yet if I added to this very porous metal, after it was melted, a small quantity of arsenic, viz.—one ounce to one pound of the metal, it was really astonishing to see how much better the metal turned out, being considerably harder than before, and incomparably less porous. I mention this circumstance, which any one may easily try, to show the very great advantage of using a small portion of arsenic to render it more compact, and, as Sir Isaac Newton justly observes, more white than before.* The use of this small portion of brass in this composition is to render it more tough, and not so excessively brittle, as this composition without the brass would prove. A small portion of silver will make the metal much whiter, though if too much is added it is apt to be porous. Having said so much relative to the composition of the metal, which indeed is a capital article, I pass on to

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* If too much tin should be added, viz.—if seventeen ounces of tin is put to thirty-two ounces of copper, the composition is not brilliant when broken, but of a gray blue and dull colour. If the quantity of tin be further increased, the metal will be almost black.

† Sir Isaac Newton melted the copper first, then added the arsenic, and lastly the tin; as, without doubt, he knew that the tin should remain in a fluid state the shortest time possible. It is true that he added the arsenic to the melted copper, but as he well knew that a great part of it would be rendered volatile, he therefore added a very large quantity of it, viz.—arsenic one, to copper six.

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* The specific gravity of the composition itself, is 8.78, with the addition of one ounce of arsenic to one pound of metal, 8.89.

The Manner of Casting the Metal.—The sand most proper for casting this, and indeed any other metal, is a fine sand with no more loam or clay mixed with it naturally, than is sufficient to make it tenacious enough to adhere together, when properly moistened. If too much clay is mixed by nature with the sand, it will always blow the metal in different directions; sometimes, indeed, to the great danger of the operator. On the contrary, if the sand does not contain a sufficient quantity of clay, it will not remain in the flasks, and take a proper impression from the pattern or model. The best sand I could ever meet with, for the purpose of casting specula, is the Highgate loam, (near London,) generally used by the London founders. It should be as little wet as may be, and well beaten, but not too hard. The flasks should be at least two inches wider than the metal intended to be cast. If the sand is not of a sufficient thickness round the metal, it will instantly become dry, when the hot fluid metal is poured into it, and consequently will contract, and of course, the fluid metal will run out of the flasks. A proper thickness of sand will, however, prevent this accident. The model, or pattern, should be made of brass or hard pewter, and must be a little larger and thicker than the speculum intended to be cast from it, as the thing cast, is always a little less than the pattern, owing to its contracting a small degree in cooling. A wooden pattern will not quit the sand near so well as one made of metal; besides, wood will always warp by the moisture of the sand, and consequently will give a false figure or form to the intended speculum. As the composition I have given for the speculum is the hardest, and consequently the most brittle of any metal yet known, so is it the most difficult to cast. The common method of casting other specula will not avail in the least degree here; and it was a very considerable time before I found out a certain and infallible way to cast them free from faults or flaws in the face. In general, they cracked in the cooling, from the moisture of the sand. The only method possible to cast them well, (for indeed I have tried many methods,) is to cast them with the face downwards. The ingate or git should be at the back of the metal, and at the very edge of it; its breadth, where it joins the metal, should be at least half the diameter of the metal, and its thickness must be half the thickness of the metal at the edge; the upper part of the git should contain as much metal at least, or even more, than the speculum itself. I could give my reader sufficient reasons for every part of the process above directed, but I might be thought too tedious; suffice it then that I inform him that he will find these directions will answer in practice, and I believe I can say, that no one whatever can cast specula of this brilliant and brittle composition, by any other means, than what I have now pointed out. When the pattern, with its ingate or git, is taken out of the sand, ten or a dozen small holes should be made through the sand, at the back of the mould, with a small wire, or common knitting-needle, to permit the air to escape as the metal is poured into the mould. I have found by experience, that several small holes are infinitely better for that purpose than one large hole.* When the metal is melted a second time, which must be done with as small a degree of heat as possible, add the proportional quantity of crude arsenic in a coarse powder, and stir it with a wooden spatula; when the fumes are gone off, take the metal off the fire, take away the dross, and add half an ounce of powdered rosin, or equal quantities of rosin and nitre, in order to give the metal a good face; stir it well with a stick, and pour it immediately into the flasks. When the git is filled up with the fluid metal, strike the flasks gently, so as to shake or jog the metal in them, in a small degree; this will prevent any flaws in the face from any air bubbles being lodged there. When the metal has remained in the flasks a few minutes, so as to become entirely solid, open the flasks while the metal is red hot, (it cannot crack in this state though it is exposed to the air, as all metals are malleable when they are red hot,) and take out the speculum with a pair of tongs, laying hold of it by the git, but take care to keep the face downwards to prevent it from sinking. Force out the sand from the hole in the middle of the mirror with a piece of wood or iron, and place the speculum in an iron pot, with a large quantity of hot ashes, or small coals, so as to bury the speculum in them a sufficient depth. If the sand is not forced out of the hole in the manner above directed, the metal, by sinking as it cools, will embrace the sand in the middle of the speculum so tight, as to cause it to crack before it becomes entirely cold. And if the metal is not taken out of the sand, and put in a pot with hot ashes or coals to anneal it, I can assert that the moisture from the sand will always break the metal. Let the speculum remain in the ashes till the whole is become quite cold. The git may be easily taken off by marking it round with a common fine half-round file, and giving it then a gentle blow. The metal is then to be rough-ground and figured.

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* See Appendix to Gregory's Optics, p. 219; or the Philosophical Transactions, No. LXXXI.

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* If several small holes are made for the air to escape, the back of the metal will be cast much neater than if one hole only is used for this purpose. Besides, when one hole only is used to let the air escape, the metal is very apt to crack in that place, owing to the sinking of the metal in casting.

The Rough-Grinding and Figuring the Speculum.—In rough-grinding, figuring, and polishing the metal, two tools only are necessary, besides a common grindstone. One chief reason why workmen do not give a good figure to their specula is, because by pursuing Dr. Smith's or Mr. Mudge's methods they use too many tools, which, in a great measure, destroy each other's effects. As nature always acts in the most simple manner, so if we could always imitate her in this respect, we should arrive at a much greater degree of excellence, in most of our mechanical pursuits. Besides, the tools generally made use of by workmen, are considerably too large in diameter, ever to give a correct and uniform figure. All the tools I make use of, are a rough-grinder, composed of lead and tin mixed together, or else of pewter; this rough-grinder serves also for a polisher; this tool, with a bed of stones, or hones, are all that are necessary. A bruiser (as directed by Dr. Smith and Mr. Mudge,) is totally unnecessary, causes considerably more work, and after all is really detrimental. The best method I have ever found to rough-grind the speculum, is to grind the surface of it quite bright, upon a common grindstone, made nearly to the figure or focus of the speculum by a gauge.* Take it then to a convex tool made of lead and tin, or else of pewter, and grind the metal upon it with fine emery. This emery, however fine it may be, will break up the metal very much; but we can easily cure that process, as I shall show hereafter. This tool, or rough-grinder, should be made of an elliptical form, and not circular (for a reason which I shall point out hereafter,) and of such dimensions, that the shortest diameter of the ellipse, shall be equal in breadth to the diameter of the mirror; and the longest diameter of the elliptical tool should be to the shortest diameter, in the proportion of ten to nine, accurately, for a reason likewise to be mentioned hereafter.

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* The grindstone may be easily brought to the form of the gauge, by holding

(To be continued.)

New and expeditious method of Squaring Numbers.

LINCOLN, JULY 2, 1827.

SIR,—Whatever has a tendency to diminish the labour of dry and tedious calculations, can hardly fail to be acceptable to some of the readers of the Mechanics' Magazine: with this persuasion, I make no apology for submitting to them a method, by which a considerable part of the usual labour of squaring numbers may be avoided; a method, which, though it embraces no new principle, seems, as far as I know, to have been hitherto unnoticed by every writer on the subject of arithmetic.

The method here pointed out is founded on the well known principle, that the product of the sum and difference of two numbers, is equal to the difference of their squares; to which difference, if we add the square of the lesser number, we obtain the square of the greater. The principal advantage of this method is, that it enables us to perform the operation, with numbers divisible by 10, 100, &c., or which contain cyphers. If we make the number, the square of which is required, the greater of two numbers, whose sum or difference is a number divisible by 10, &c., and multiply together the said sum and difference, and to their product add the square of the lesser number, the result is the square required. For example: let 83 be a number whose square is required; then $83 + 3 = 86$, and $83 - 3 = 80$, the sum and difference; the product of which is 6880; to which add 9, the square of the lesser number 3, and we have 6889, the square of 83. If the number to be squared ends with 5, the process is still shorter, for taking 5 for the lesser number, the sum and difference are both divisible by 10: thus, $85 + 5 = 90$, and $85 - 5 = 80$; whence $90 \times 80 + 25 = 7225 = 85^2$.

The intelligent reader will perceive, that in every case we save the trouble of multiplying by at least one figure; and in many cases of much more. For example, take 997; then $997 + 3 = 1000$, $997 - 3 = 994$; by a mere mental process we obtain 994009, the square required.

the sharp end of an iron bar against it while it is turned round, till so much is worn away from its surface as shall cause it to take the true curvature of the gauge.

It is presumed, sufficient has been said to explain the above method, and to show its utility. It is equally applicable to whole or mixed numbers, fractional or decimal, and may frequently be applied with singular advantage in all. Take, for instance, the famous "Arithmetical Question," which called forth the mental energies of so many of your correspondents in your first volume. We have 99*l.* 19*s.* $11\frac{3}{4}$*d.*, or $99\frac{959}{960}$, and $\frac{1}{960}$; their sum 100, their difference $99\frac{958}{960}$; their product is instantly obtained $= 9900\frac{9580}{90} = 9999\frac{76}{96}$, or 9999*l.* 15*s.* 10*d.*, to which add $(\frac{1}{960})$ or $\frac{1}{960}$ qrs., and the answer is obtained. Perhaps it may be still more readily done without reducing to fractions; thus 99*l.* 19*s.* $11\frac{1}{2}$*d.* × 100 = 9999*l.* 15*s.* 10*d.*, to which add $\frac{1}{990}$ qrs. as before. On this question allow me to say, that entertaining the same views as your former correspondents, I have no wish to revive a subject, which, together with the contentions it excited, has long since descended to "the tomb of all the Capulets;" yet, as it was allowed on all hands that the answer required was the square of the number $99\frac{959}{960}$, I trust that the calling in its aid to illustrate my subject, will not be thought derogatory to its posthumous fame.

I now proceed to inquire how far a similar method can be applied with advantage, to the finding the products of numbers in general. Let a and b be two numbers, whose product $a\,b$ is required, a being the greater; let $a + r$ and $b - r$ be two other numbers, one or both of which is divisible by 10; it is evident that $(a + r)(b - r)$ is less than ab: let n be the difference; then $(a + r)\ (b - r) + n = ab$, an equation in which $n = (a - b + r)\,r, = (d + r)\,r$ when $d = a - b$. And this value of n, added to $(a + r)\ (b - r)$ we have ab as required. Again, if it be convenient to take $a - r$ and $b + r$ for the two auxiliary numbers, then because $(a - r)\ (b + r)$ is greater than ab, let n be the difference, and we have $(a - r)\ (b + r) - n = ab$, whence $n = (a - b - r)\ r, = (d - r)\ r$; which subtracted from $(a - r)\ (b + r)$ gives ab as before: from hence we obtain the following convenient general rule. Arrange the four numbers like the terms of a proportion in the following order:—$a \pm r, a, b, b \mp r$. "Find the product of the difference between the first and second, and first and third terms, which is the value of n; then, if the first term be greater than the second, *add n to*, if less, *subtract it from* the product of the extremes; the result is the product of the mean terms."

As my object is to write intelligibly rather than learnedly, I hope an example or two will cause it to be understood by all. Let the numbers whose product is required be 96 and 93; then, taking $r = 4$ and arranging as above directed, the terms will stand thus: 100, 96, 93, 89. The product of the extremes is 8900, to which add (100 — 96) (100 — 93.) or 4 × 7, = 28, the value of n, we get 8928 = 96 × 93. Again, let $a = 95, b = 85$; then $a - r = 90$, $b + r = 90$; the terms will stand thus, 90, 95, 85, 90. And we have $n = (95 - 90)\ (90 - 85,)$ or $5 \times 5 = 25$, which, as the first term is *less* than the second, must be subtracted from 8100, the product of the extremes; the result is 8075, the product required.

From the above examples it appears, that when the numbers are such that the value of n can be obtained mentally, or with little trouble, there is a decided advantage in using this method. I have neither time nor inclination to pursue this subject further at present, but should be glad to see it taken up by some one better qualified for the undertaking; what I have done, I submit, with great deference, to the judgment of the candid and judicious reader. J. B.

P. S. Since the above was written, I have had the pleasure of witnessing the surprising powers of Master Noakes, a child of seven years old, who is now itinerating in this county, for the purpose of displaying his abilities in arithmetical computations. I was much gratified to find, that in the squaring of numbers, he uniformly made use of the above method. Whether he has been taught it, or whether it *suggested itself* to his extraordinary mind, I did not ascertain; nor is it of consequence to know: it is sufficient that we have, at least, *his* approbation in its favour. [*London Mechanics' Mag.*

Notice of the pressure of the Atmosphere, &c. within the Cataract of Niagara, in a Letter from Captain Basil Hall, *Royal Navy,* F. R. S.

TO PROFESSOR SILLIMAN.

New York, Oct. 29, 1827.

My Dear Sir: If you think the following notice of an experiment which I made at Niagara, early in July last, worthy of a place in your excellent Journal, it is much at your service.

You may remember, perhaps, that some time ago, it was suggested by Messrs. Babbage and Herschell, in a paper, I believe, upon barometrical measurements, that there was reason to suspect a change of elastic pressure might be found in the air near a water fall; and it occurred to me, when I was making preparation for the present journey, that a good opportunity, for bringing this subject to the test of experiment, might present itself at the Falls of Niagara. I accordingly provided myself with a mountain barometer, of great delicacy of workmanship, in some degree differently fitted up from the ordinary instruments of this description; and it may be worth while, to mention the particulars of its construction.

In the first place, as it is essential to the accuracy of barometrical measurements, that the tube be held in a vertical position, and as the instrument is often exposed, especially at the upper stations, to the action of high winds, it is of consequence, to have some method of ensuring this position throughout the observations. Mr. Thomas Adie, instrument maker, in Edinburgh, in conjunction with Mr. Jardine, the eminent civil engineer, devised a small fixed circular spirit level on the top of the instrument, the bubble of which is made to stand at the centre, when the tube is perfectly upright. In order to bring it to this position, four screws are necessary at the collar, near the centre of motion, by which, not only the requisite adjustments are made, but the instrument can afterwards be firmly secured in its place. In other respects, it did not differ from the best mountain barometers, where both surfaces of the mercurial column are capable of being observed; and where, consequently, the observation being direct, no allowances or corrections are required.

Some days after reaching Niagara, I went behind the sheet of water, on the Canada side of the Falls, and although circumstances did not promise very favourably, I resolved to try what could be done with the barometer, in a place where no similar instrument had probably ever been set up.

I think you told me that you did not enter this singular cave on your late journey; which I regret much, because I have no hope of being able to describe it to you. In the whole course of my life, I never encountered any thing so formidable in appearance: and yet. I am half ashamed to say so, as I saw it performed by many other people, without emotion; and it is daily accomplished by ladies, who think they have done nothing remarkable.

You are perhaps aware, that it is a standing topic of controversy every summer, by the company at the great hotels, near the Falls, whether the air within the sheet of water is condensed or rarified; I had therefore a popular motive as well as a scientific one, in conducting this investigation; and the result, I hope, will prove satisfactory to the numerous persons who annually visit Niagara.

As a first step, I placed the barometer at the distance of about one hundred and fifty feet, from the extreme western end of the Fall, on a flat rock, as nearly as possible on a level with the top of the 'talus' or bank of shingle, lying at the base of the overhanging cliff, from which the cataract descends. This station was about thirty perpendicular feet above the pool, or basin, into which the water falls. The mercury here stood at 29.68 inches. I then moved the instrument to another rock, within ten or twelve feet of the edge of the fall, where it was placed, by means of a levelling instrument, exactly at the same height as in the first instance. It still stood at 29.68—and the only difference I could observe, was a slight continuous vibration, of about two or three hundreths of an inch, at intervals of a few seconds.

So far, all was plain sailing: for though I was soundly ducked by this time, there was no particular difficulty in making these observations. But within the sheet of water, there is a violent wind, caused by the air carried down by the falling water, and this makes the case very different. Every stream of falling water, as you know, produces, more or less, a blast of this nature: but I had no conception that so great an effect could have been produced by this cause. I am really at a loss how to measure it—but I have no hesitation in saying, that it exceeds the most furious squall or gust of wind I have met with in any part of the world. The direction of the blast is generally slanting upwards, from the surface of the pool, and is chiefly directed against the face of the cliff, which being of a friable shaly character, is gradually eaten away; so that the top of the precipice now overhangs the base, thirty-five or forty feet; and in a short time, I should think, the upper strata will prove too weak for the enormous load of water, which they bear, when the whole cliff will tumble down. These vehement blasts are accompanied by floods of water, much more compact than the heaviest thunder shower; and as the light is not very great, the situation of the experimenter with a delicate barometer in his hand, is one of some difficulty. By the assistance of the guide, however, who proved a steady and useful assistant, I managed to set the instrument up, within a couple of feet of the "termination rock," as it is called, which is at the distance of one hundred and fifty-three feet from the side of the water fall, measured horizontally along the top of the bank of shingle.

This measurement, it is right to mention, was made a few days afterwards, by Mr. Ed. Deas Thompson, of London, the guide, and myself, with a graduated tape.

While the guide held the instrument, firmly down, which required nearly all his force, I contrived to adjust it, so that the spirit level on the top, indicated that the tube was in the perpendicular position. It would have been utterly useless to have attempted any observation without this contrivance. I then secured all tight, unscrewed the bag, and allowed the mercury to subside: but it was many minutes before I could obtain even a tolerable reading, for the water flowed over my brows, like a thick veil, threatening to wash the whole affair, philosophers and all, into the basin below. I managed, however, after some minutes delay, to make a shelf or spout with my hand, which served to carry the water clear of that part of the instrument, which I wished to look at, and also to leave my eyes comparatively free. I now satisfied myself, by repeated trials, that the surface of the mercurial column, did not rise higher than 29.72. It was sometimes at 29.70, and may have vibrated two or three hundredths of an inch.

This station was about ten or twelve feet lower than the external ones, and, therefore, I should have expected a slight rise in the mercury; but I do not pretend to have read off the scale, to any great nicety; though I feel quite confident, of having succeeded in ascertaining, that there was no sensible difference between the elasticity of the air at the station on the outside of the falls, and at that, one hundred and fifty-three feet within them.

I now put the instrument up, and having walked back towards the mouth of this wonderful cave, about thirty feet, tried the experiment again. The mercury stood now at 29.68, or at 29.70, as near as I could observe it. On coming again into the open air, I took the barometer to one of the first stations, but was much disappointed, though I cannot say, surprised, to observe it full of air and water, and consequently, for the time, quite destroyed. My only surprise, indeed, was, that under such circumstances, the air and water were not sooner forced in. But I have no doubt, that the two experiments on the outside, as well as the two within the sheet of water, were made by the instrument, when it was in a correct state; though I do not deny, that it would have been more satisfactory to have verified this, by repeating the observations at the first stations.

On mentioning these results to the contending parties in the controversy, both sides asked me the same question. "How then, do you account for the difficulty of breathing, which all persons experience, who go behind the sheet of water?" To which I replied, "that if any one were exposed to the spouts of half a dozen fire engines, playing full in his face, at the distance of a few yards, his respiration could not be quite free; and for my part, I conceived that this rough discipline would be equally comfortable in other respects, and not more embarrassing to the lungs, than the action of the blast and falling water, behind this amazing cataract."

I remain, most sincerely, your obedient servant,

BASIL HALL.

[*Silliman's Journal.*

Mr. Genet's remarks on the animadversions of the Editor, on his memorial, on the Upward forces of Fluids.

IN the number of Professor Silliman's Journal, for the present month, (January,) we find the subjoined communication from Mr. Genet; our readers will perceive that it is dated in August last; we are not yet informed of the result of the experiments, in the *laboratory*, and *school* of *aerostation* at fort Gansevoort; when any thing important transpires, we shall hasten to spread it out on our pages. We did not expect an *answer* to our lucubrations, but supposed, as appears to be the case, that Mr. Genet would follow his friend Pascalis into dignified retirement; *neque semper arcum tendit Apollo.*

TO PROFESSOR SILLIMAN.

New York, August 30, 1827.

"*Sir*—Through the kindness of your printer, I have received a proof sheet of Dr. Jones' (I am ashamed to repeat it, for the honour of philosophy,) *animadversions* on my memorial, on the upward forces of fluids, and if it is not too late,* I hope that these few lines will also find, in the same number of your Journal, where those appalling *animadversions* will appear, the following humble and short rejoinder; namely, that being satisfied that in experimental philosophy and practical mechanics, results and facts are the best means of settling points in dispute, I have cultivated, since last fall, in this city, the friendship of philanthropic philosophers, whose pleasure consists in encouraging whatever may eventually be useful; of liberal citizens, who are always willing to promote the arts; of good hearted mathematicians, who like better to rectify than to rebuke; and of able and public spirited mechanics, whose experience is a sure guide; and that owing to those favourable circumstances, and an elaborate investigation of whatever, in the science of mechanics, has any connexion with my plans, I have very much improved my mechanical combinations, for the navigation of the air and water, by hydrostatic and aerostatic forces. I shall, in a few days, sir, be able to make experiments that will attest, 1st, the available power of hydrostatic pressure, and aerostatic levity, to propel boats or vessels, deducting all friction and resistance; and 2nd, the additional advantages of a pump totally different from those that I had at first contemplated, that will double, instead of diminishing, my powers. I have been also preparing a system of machinery, very much simplified, to steer the aeronauts in favourable currents, and endow them with the faculty of raising and lowering themselves by inclined planes, into more favourable strata, if they meet adverse ones: and when my friend Eugene Robertson, whom I expect every day, is arrived, we shall be able to begin progressively, according to our means, our aerostatic experiments, in a fort of this city, which, under the auspices of our general government, solicited by Mr. Clinton, governor of this State, has been designated for that purpose. The spacious and circular yard of that fort, called, after the late general Gansevoort, and the adjoining buildings, will become an excellent laboratory and school of aerostation. In the mean while, Dr. Jones may animadvert as much as he pleases; he may rest assured that I shall not take the trouble of answering his lucubrations, following in that respect, the example of Montgolfier, who, when he published his discovery of the balloons and his contemplated experiments, was assailed from all quarters, with the most scientific dissertations, attempting to prove by all the rules of mathematics, and the formulas of algebra, that he would fail. I am, I confess, more than ever sanguine in my expectations; but if I am disappointed, you will, I know, sir, be one of those who will say, as of the unfortunate Phæton, *Magnis tamen excidit Ausis.*

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* The number containing Dr. Jones' animadversions was already finished when this letter arrived.--[*Silliman.*]

Respectfully yours, E. C. GENET."

A description of the mode of extracting the Fecula from the Potato.

Communicated from G. G. BARRELL, Esq. Consul of the United States, at Malaga, to H. A. S. DEARBORN, Esq. Boston.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Brinley Place, Roxbury, Oct. 29, 1827.

SIR—Last December, I received a communication from G. G. Barrell, Esq. Consul of the United States, at Malaga, containing a treatise on the mode of extracting the fecula from the potato, which was published in the New England Farmer. Mr. Barrell has since transmitted to me, drawings of the machine, described in the treatise, which I offered to Mr. Fessenden, to be engraved for his paper; but he observed that he could not get them done in such a manner, as to do justice to the delicate parts of the machinery, or he should willingly give them publicity. As Mr. Barrell has discovered great solicitude, to render the information he has obtained, useful to his country, I have thought, it could not be better done, than through the medium of the Franklin Journal, and therefore enclose a copy of the first communication, which was printed in the N. E. Farmer, and an extract from Mr. Barrell's last letter, with the drawings. If you deem them worthy of notice, I shall be obliged to you for giving them publicity.

Besides the various uses named in this correspondence, to which the fecula of the potato may be applied, there is that of starch, in our numerous cotton manufactories, and in the laundry of every family. On inquiry, I find there were used last year, in the Waltham Factory, 37,734 pounds of starch, which cost 2,075 $\frac{37}{100}$ dollars; from which it results, that the annual consumption for the cotton factories alone, in the six New England States, must amount to at least 1,000,000 pounds, and cost over 50,000 dollars. From these data, it can readily be perceived how great is the demand in the whole Union, for all the purposes to which starch is now applied.

With great respect, &c.

H. A. S. Dearborn.

Brinley Place, Roxbury, December 13, 1826.

Dear Sir—The enclosed treatise on the mode of extracting the fecula, or flour, from the potato, was recently transmitted to me, by G. G. Barrell, Esq. Consul of the United States at Malaga, who states that "it was drawn up by a most intelligent and worthy man," and he desires "that it may be published for the public good."

Mr. Barrell is of opinion, that appropriating the potato, both of the northern and southern states, to this use, cannot fail of becoming of vast importance to the country; not only as a substitute for sago, arrow-root, and other delicate aliments, but, for flour in pastry, and as starch; of which, great quantities are imported into all the West India Islands, South America, Mexico, and the Italian States, at an enormous expense.

Mr. Barrell has before evinced his solicitude for the advancement of agriculture, by forwarding several kinds of grain, and valuable information, on the method of cultivating them, to one of our societies. Such instances of patriotic zeal, and generous devotion to the prosperity of his native land, merit the grateful acknowledgments of his fellow citizens. It is by such contributions to our fund of intelligence, upon all the branches of national industry, that Americans, who reside in, or visit foreign countries, can best subserve the republic; and it is pleasing to find, that many of them cheerfully avail themselves of the advantages of their situation; and it is most desirable, that all our public agents should make it a point to collect and transmit to the United States, whatever may tend to increase the number and variety of our products, of agriculture, manufactures and the arts.

Very respectfully, yours, &c.

H. A. S. Dearborn.

J. G. Fessenden, Esq. *Editor of the N. E. Farmer, Boston.*

Malaga, September 26, 1826.

Dear Sir—Permit me to communicate to you, the result of an essay I made some days ago on the sweet potato, a native of the free and happy country you so worthily represent, and where I think that the use, to which this excellent vegetable is generally applied, may be improved to great advantage.

You, no doubt, have heard of the vast consumption, which has lately taken place in France, of the fecula, or flour, proceeding from the common potato; where, in consequence of the repeated certificates, given by the Proto Medicate of Paris, it has been introduced into almost all the apothecaries' shops, and hospitals, in the south of France, and is found to produce a variety of most delicate and nutrimental aliments, for people of weak digestion and relaxed intestines; such as excellent gruel, porridge, and all kinds of pastry, far superior to that made with flour; as also starch of the very first quality; and which nothing, apparently, could exceed in whiteness.

A consideration of these facts, first induced me to turn my attention to the sweet potato, and suggested the idea, that it might be applicable, in some degree, to the same purposes; and having accordingly resorted to the process usually adopted, for extracting the fecula of the common potato, I found, to my no small surprise and satisfaction, that it produced that substance, in vastly greater quantity, and, if possible, in superior quality, particularly in whiteness; besides possessing in a much greater degree, the saccharine qualities inherent in the plant.

These circumstances will, no doubt, suggest an idea, to a person of your active and penetrating mind, of the immense advantages, that would, unquestionably, accrue to the southern states of America, from applying this admirable vegetable to the many purposes of which it is susceptible. I shall, therefore, proceed to describe to you the simple method which may be used, for the extraction of the fecula. It is as follows:—

A wooden cylinder [*see the drawings*] is required, of about three feet in circumference, and four in length, covered with tin, perforated like a grater, which on wearing out, may be taken off and renewed; on the top is placed a wooden box, or hopper, capable of containing five or six bushels, in such a manner as to embrace about a quarter of the circumference of the cylinder, and so adjusted to it, as only to let the fibres of the potatoes pass in the operation of grinding. This cylinder, with its hopper, is placed over a tub, of an oval form, and filled with water, in such a manner, as that it should dip in that element at each rotation, which is performed by means of a crank, like that of a grindstone; by this means, the paste and fibrous substance are washed away, and the instruments kept clear; there falling, together with the fecula, into the water, a separation immediately takes place; the latter by its specific gravity precipitating itself to the bottom of the tub, where, in a few minutes after pouring off the water with the fibres, it appears white, and in a solid compact mass. In order to complete the operation, nothing further is requisite, than to stir it up with clean water, and percolate it once or twice, through a sieve, when it becomes of a whiteness far surpassing common flour, or starch, and of a more glutinous and tenacious quality than the latter.

According to the experiment I have made, with respect to the quantity of fecula produced, by the sweet potato, I find that four and a half bushels of that vegetable, when at maturity, will produce one bushel of fecula, which is at least 50 per cent. more than the produce of the common potato, in this country; it has besides the grand advantage of being fit for use all the year round, if properly preserved, it being but in a very small degree, subject to germination; whereas, the common potato on beginning to sprout, produces very little fecula; and is in a state for grinding, only about five months in the year. The fibres of both kinds of potatoes make excellent food for cattle, pigs, sheep, fowls, &c.

The fecula, when extracted, is dried in the sun, on thin plates, either of glazed earthenware, or tin; and may be formed into any shape, or made fine like flour.

In order to facilitate the operation, on a grand scale, a fly wheel may be applied to two or more cylinders, at the same time, by placing them within about three or four inches of one another, by which means, immense quantities of potatoes may be ground in a day, without a greater impulse than that of a single man, or even a turnspit dog. In a country, however, where the powers of machinery, and steam, are so well known, as in America, it would be useless and impertinent to make further observations on that subject: I shall, therefore, conclude with a few observations on the washing of the potatoes, previous to grinding them for extracting the fecula. This operation is of the greatest consequence, and in fact is the only laborious part of the process, as it is usually conducted; as great care must be taken to have the potatoes well washed, in order to prevent the earth accompanying them, from mixing with the fecula; and it appears to me, that a more expeditious method might be invented, than the common one; as, by suspending, horizontally, a long cask, which may be turned, like the above mentioned cylinders, by a fly wheel; this might be filled about two-thirds full of potatoes, and afterwards filled nearly full of water. It should be furnished on the inside with strong bristles, in the form of a hard brush, and here and there long wooden pins, rounded at the end, to prevent the bruising them too much in the act of rotation, which would be very violent. It should likewise have a cock, or plug, at the bottom, for drawing off the water when soiled, which may be renewed, till they are thoroughly cleansed. The whole of this operation may be performed in a very few minutes.

Your infinitely obliged,
And very faithful servant and friend.

To G. G. Barrell, Esq.

[to be continued.]

FOR THE FRANKLIN JOURNAL.

Observations on the situation of the Fulcrum in Levers; and on Stress and Friction on Journals, in the communication of Motion. By R. Tyler, *Mechanician.*

TO THE EDITOR.

Sir—It has been frequently observed, that a lever of the second kind, has the advantage of being shorter than one of the first kind, of the same power, and length of arm. It does not appear, however, that the observation has been generally followed up, so as to derive those advantages from it, which, I think, a little attention will make evident. It is curious also to observe the great practical superiority of this kind of lever in many other respects, particularly where only a small gain of force is required, say, for example, a force of 2 to 1, that is, that, in either case, the longer, shall be to the shorter arm, in that proportion.

That there is a difference in their length, will be evident from the consideration, that in one case, the long and short arms are on opposite sides of the fulcrum, while in the other, the short arm forms a part of the longer one, being on the same side of the fulcrum; and a moment's reflection will make it clear, that in the present example, the length of the lever of the second kind, is to that of the first, as 2 to 3. It is evident, that the same proportion would hold good for their relative weight, supposing them to be bars of even thickness, and equal to one another; but it appears that the longer bar should have just twice the stiffness of the shorter one, and therefore must be considerably increased in thickness, for, the momenta of the forces acting at the extremities of the longer lever, are twice as great as the momenta of the forces at the extremities of the shorter lever; it follows, therefore, that the tendency of these forces to strain, or bend, the levers, at the third or middle force, is twice as great in the longer, as in the shorter lever; hence it appears, that their weights will probably be nearly, as 2 to 5, in well proportioned levers.

A reference to the figures will show, that in fig. 1, the fulcrum F is pressed with a force three times as great, as that in fig. 2; hence the *strength* of those axles, or centre pins, should be three times as great in fig. 1, as in fig. 2; but it is requisite that the extent of the rubbing surface of each fulcrum, should bear a due proportion to its load; wherefore its *diameter* (if a cylindrical pin, or bolt) should be about double the size in the former, as in the latter case. Now the friction of a sliding body, being as the pressure, nearly, and the power or influence of *any force*, concerned in the lever, as its distance from the centre of motion, we have only to multiply the pressure on each fulcrum, by its diameter, to find the relation of friction in the two cases. In fig. 2, the pressure, and the diameter, and their product is 1, and in fig. 1, the pressure being 3, and the diameter 2, the product is 6, showing the *friction* to be as 1 to 6.

The comparison will be better shown by the following table:

Length	as 2 to 3	Do. on fulcrum	as 2 to 6
Weight	as 2 to 5	Diam. of do.	as 2 to 4
Stress	as 2 to 4	Friction of do.	as 2 to 12

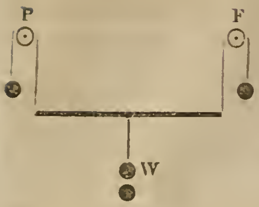


Fig. 2.

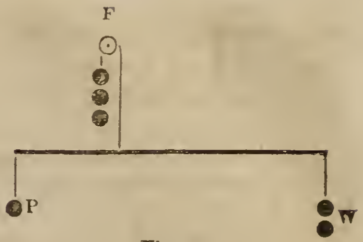


Fig. 1.

To which may be added a corresponding difference in the beds, or frames, in which the levers are used.

Connected with this subject, I may remark that too little attention is paid to the avoiding of stress and friction, in the arrangement of machines generally. We frequently see the power communicated to a machine, through a train of wheels, pullies, drums, &c., all acting as levers of the first, instead of the second kind, even where the speed is not changed; in which case the arms of each lever being equal, the disparity between the first and second kind, as regards friction on the axles, is infinitely greater than in the case above represented, that is to say, that in levers of equal arms, when the second kind of lever is employed, there is *no* force thrown on the fulcrum in consequence of the action of the *power* and *weight*, these forces being exactly opposite to each other; whereas, in the lever of the first kind, the fulcrum being placed between the power and weight, sustains the sum of both, and this, of every axle in the train, from the first mover, to that immediately concerned in performing the work.

I do not mean to say that such arrangements are not sometimes judicious, and even unavoidable, but, that they more frequently arise from the ignorance, or inattention, of the engineer.

Every skilful mechanician knows that the friction of a machine, depends in some measure on the number and nature of the rubbing surfaces; but he does not always bear in mind, especially when each axle has its own appropriate work assigned it, that every one in the train, sustains a load, equal to twice the *degree* of force communicated through it, to the next succeeding wheel, or drum, independently of that which arises from its own particular resistance; and that this takes place in the lever of the first kind, only.

I am aware, that the example above mentioned of the second kind of lever, of equal *arms*, is a contradiction of terms; that it is *as much* a lever of the third as of the second kind, or may, in fact, be considered as no lever at all, since there is no third force or fulcrum required; still it is no more than an extreme case, and therefore very proper for the purpose of illustration.

In order then, to diminish as far as possible the stress and friction in the communication of motion, or power, by means of the lever, whether in the wheel, pulley, or drum, &c. it may be laid down as a rule, that *the power and resistance* (*or weight*) *should always act on* *the same side of, and at equal distances from, the fulcrum.* A rule, which though it cannot often be strictly observed, will repay the trouble of bearing in mind.

It may be worthy of remark in this place, that the weight of a heavy wheel, or shaft, may sometimes be employed as a substitute, for pressure on its journals, in order to confine it in its proper situation.

Fig. 3.

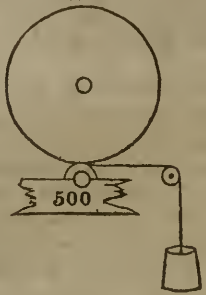
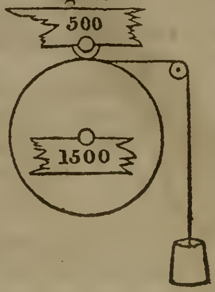


Fig. 4.



An example is presented in fig. 3, where a vertical sparr wheel weighing 500 pounds, receiving its motion from a small pinion at its lowermost point, is just sufficiently heavy to keep it in contact with its driving pinion, and prevent it from being raised *out of gear*, while it is employed in raising a heavy weight, or otherwise exerting an enormous force, in direct opposition to that received from the pinion. Abstract the weight of the pinion, and it is evident that the only pressure on the journals of both wheel and pinion, is that caused by the weight of the wheel, viz. 500 pounds on the bearing underneath. Now if we suppose the weight of the wheel to be taken away, we shall in its stead require a pressure downwards, of 500 pounds on its journal; while that under the side of the pinion, will not be at all effected by the change; but we shall then have 1000 pounds pressure, 500 below and 500 above: if we now add to the pinion the weight which we have taken from the wheel, we shall then have 1500 pounds pressure, or 1000 below, and 500 above, and we shall have only placed the pinion, or light wheel, above, as in fig. 4. If we suppose (as is natural) the pinion to have weight, we still have this rule, by which to determine the case, in placing the lighter wheel above, and below; the difference of pressure on the journals will be equal to double the difference in the weight of the wheels; the heaviest wheel being just sufficient to overcome their tendency to separate.

Patent Phenix Mill Canvass.

We have received a small pamphlet containing very satisfactory certificates of the superiority of the sail duck, manufactured at Paterson, New Jersey, by the Phenix manufacturing company, and should have noticed it in our last number, but for the disarrangement consequent upon the fire in Mr. Harding's office. We shall always be obliged by the receipt of information either from individuals or companies engaged in manufacturing establishments, which will enable us to take such notice of them as their extent and utility may justify. But few of our own citizens are aware of how much is really done in manufactures, and are, consequently unable to make a correct estimate of the importance of this branch of industry, and of the justice and force of its claims to public and private patronage. A correct and full view of what we have actually accomplished in this way, would have a salutary influence upon the minds of our own citizens, and would exhibit us to foreign countries, as having attained a state of vigorous maturity, in the lapse of a few years, of which they have no conception, but which, when known, must tend to our advantage.

The following is extracted from the pamphlet above named:—"As ship owners, those interested in shipping, and the friends of domestic manufactures, must see their own advantage in being independent of foreign nations in the important article of *canvass*—the duck manufactured at this establishment is brought to your notice and patronage, in the confidence that it will be found more economical than any foreign canvass, as will be satisfactorily confirmed, by referring to those who have been in the habit of consuming the article.

"The material of which it is composed, is the best water retted flax that can be procured—the warp and filling are doubled and twisted into twine, which makes the yarn nearly twice the diameter and strength of the yarn of other canvass—the quantity of material in the same surface is consequently greater, which necessarily increases the durability, and yet its softness and pliability far exceed that of any other description, which, in handling a sail, is an important requisite.

"The cloth is woven without starch, which renders it less liable to mildew, and it is a fact well established, that this is the bane of all foreign canvass, causing more destruction than the actual wear.

"The cloth is bleached by steeping in an alkaline ley, without any preparation that can injure the fibre of the yarns, or texture of the cloth; and great confidence is experienced in recommending this canvass, as no expense or labour is spared to improve the quality, in every process of the manufacture.

"Orders for *U. S. Navy Duck*, *Russian Imitation Duck*, *Cotton Bagging*, *Hammocks*, *Hammock Cloth*, *Tarpaulins*, and all kinds of *Flax Yarn and Cloths*, will be thankfully received, addressed to 'THE PHENIX MILL, PATERSON, N. J.'"

The certificates are of different dates, from 1820 up to the present time: the first is from the navy commissioners, and is signed by Commodore Rogers; it states the result of a trial by Commodore Porter to be, that this canvass proved "to be greatly superior to either English or Russia. It possessed twice the durability." "The Commissioners of the navy are decidedly of opinion that the American canvass, tested by them, is greatly superior to any ever imported into our country.

Captain Hamilton states that "after a voyage to Liverpool and back to this place, (Philadelphia,) during which they were in constant use, and exposed to a good deal of tempestuous weather, they retain the appearance of having been bent but a few days."

Capt. Barnard of New York says, "I have the highest opinion of its goodness. In the first place, it does not mildew like foreign canvass—it is soft and pliable, and wears much better than any canvass I ever used—nor does it shrink and stretch like foreign canvass, having had it in use two voyages to Europe, and experienced very bad weather."

Captain E. Hawkins of the Havre packet line, New York, says, "I have worn the Phenix Mill duck, for some time, and can safely say that I have the highest opinion of its pliability, durability, and resistance of mildew. Those who try it will scarcely procure any other, as it will undoubtedly be found the best and most economical canvass that we can procure any where, and I have great pleasure in recommending it to the notice of all consumers of the article."

There are numerous other certificates to the same effect.

The first cost of the American canvass is stated to be less than that of Holland, or Russia, notwithstanding its greater durability. The pamphlet closes with the following remarks.—"The great superiority of this duck consists in the fact that it does not mildew, which does not arise from the use of any process to prevent it, but from the circumstance of not using that which causes it.—Many attempts have been made in England to deprive the starching of its destructive power, by tanning and the use of acids, but all in vain. As long as manufacturers pay more attention to the appearance than they do to the substance, so long will it be used in all cloth, and its injurious effects will continue to be experienced by the consumer.

"In nearly seven years' experience in the wear of this article, during which time we have had repeated contracts with the Navy of the United States, we never have had a complaint of duck manufactured from water retted flax; we feel, therefore, that we are justified in recommending it to the ship owner; more especially as the foregoing letters carry with them unequivocal proofs, of its superiority over any other description of canvass—and these evidences of its excellence are accumulating upon us every day.

"It is our interest to sustain the good reputation of the duck, as we have invested a capital of 140,000 dollars in buildings and machinery: it can never be supposed, therefore, that for a temporary gain of one thousand dollars, we should make an inferior article, and, with loss of reputation, sacrifice this capital. On the contrary, our interest and our disposition both demand of us, that we should even improve in quality; and we are consequently desirous of possessing every information which the ingenuity and experience of those who use it can suggest.—We trust and hope that those intentions will meet with a corresponding good feeling on the part of the consumers, and we shall insure that encouragement which we have some right to expect from our enterprise."

Townsend's 'Mechanics' Assistant.'

Although the invention under the above designation, has been long in use, we think that it is not as extensively known, or as highly appreciated as it merits to be. Workmen who have followed a particular routine in their operations, are rarely willing to deviate from the beaten track, excepting the new procedure can at once be made visible, and palpable, in all its parts. This state of things, however, has been visibly changing, for some years past, and a brighter era is dawning upon us, as the artisan is becoming convinced that the light of science, which has conducted the philosopher in the attainment of the true theory of many of the operations of nature, is practically applicable to his pursuits, and will enable him to perform his labours with greater facility, and to attain a higher degree of perfection than could be hoped for without its aid.

The instrument denominated the Mechanics' Assistant, consists of a brass scale, a little upwards of six inches long, and four inches wide, and by the aid of which millwrights, pattern makers, blacksmiths, carpenters, and other mechanics, may be saved the trouble of numerous tedious calculations, or, which is frequently more tedious, the arrival at the needed result, by numerous trials. We cannot detail all the purposes to which the scale is applicable, but the following will suffice to show its utility. By it may be found,

The pitch circle of any number of cogs, and any pitch;
The laying off of bevel gears, in every change of direction;
The velocity of water per second, under different heads;
The velocity of wheels when loaded;
Laying off hoppers, potters' flasks, rafters for roofs, &c.;
Ascertaining the width of streams;
Sloping the ends of braces;
Making bands, hoops, &c.;
Measuring the area of a circle; and
Finding the square which shall correspond with it;
Finding the cubic contend of cylinders, &c. &c.

The scale is accompanied by a pamphlet, which gives a clear explanation of its application to the above, and many other purposes. There are also a number of printed certificates of its value; and we have in our possession many others, written by practical mechanics, who declare that it has been a sure guide to them, and has many times repaid its cost.

Mr. David Townsend, who resides at Beaver Falls in this state, has sent some of his instruments and pamphlets to Philadelphia, for sale, and they are now in the hands of Mr. Dobson, where those interested may call and see them. The price of them is ten dollars.

Tyler's Improved Turning Lathe.

[With a plate.]

We gave, in Vol. 3, p. 186, a description of Mr. Tyler's turning lathe, which description was accompanied by a plate, showing its structure, in detail, and to this we refer for information on this point. The plate which we now give, is more correctly drawn, and exhibits it on its cast iron stand, as recently constructed. The attention of the mechanic is particularly called to the fact of the superiority of cast iron, as a collar, a fact which has been fairly tested, and which not only diminishes the labour of the maker, but gives a solid, instead of an inserted collar. We subjoin a letter from Mr. Tyler, to which we do not think it necessary to add any thing further.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—Since your publication of a description of my lathe in March last, I have entered more largely into the business of lathe making, and in consequence have found it necessary, to make such improvements and alterations as would best adapt it to general use.

In order to bring the expense within the reach of every one desirous of having a good lathe, I have omitted every appendage not absolutely necessary to its usefulness; in place of the bureau part, supporting the table, I have substituted cast iron legs, through which are made holes for the pivots of the treadle, and the crank axle. It has, I think, been well proved, that the steel collar for the mandril to run in, may be dispensed with, the cast-iron itself being better for that purpose, as it is found to run a much longer time without oil.

I herewith send you a drawing of the lathe with its stand, above referred to, and which is also a better representation than that formerly published; should you think proper, you will greatly oblige me by inserting this in your useful work. R. Tyler.

List of Patents granted in the United States, from February 15*th, to May* 31, 1827.

FOR INVENTIONS AND IMPROVEMENTS.

In the mode of packing cotton; William C. Thomas, Richmond County, N. C. Feb. 15.

In the kiln for burning lime; Abel James, Mill Creek Hundred, Del. Feb. 15.

In manufacturing copperas; Isaac Tyson, Baltimore, Feb. 15.

In making wheels for carriages, being a machine called the wheelwright's assistant; John Sitton, Pendleton, S. C. Feb. 15.

In the apparatus for constructing teeth for harrows; Wm. M'Canaughey, New Gardiner Township, Penn. Feb. 16.

In the washing machine; Chester Stone, Middlebury, Conn. Feb. 17.

In the horse rake, for hay and grain; Moses & Samuel Pennock, East Marlborough, Penn. Feb. 17.

In preventing moths and worms from injuring skins; Samuel Storm, New York, Feb. 17.

In a machine for grinding clay for making bricks; Benjamin H. Hill, Richmond County, Geo. Feb. 17.

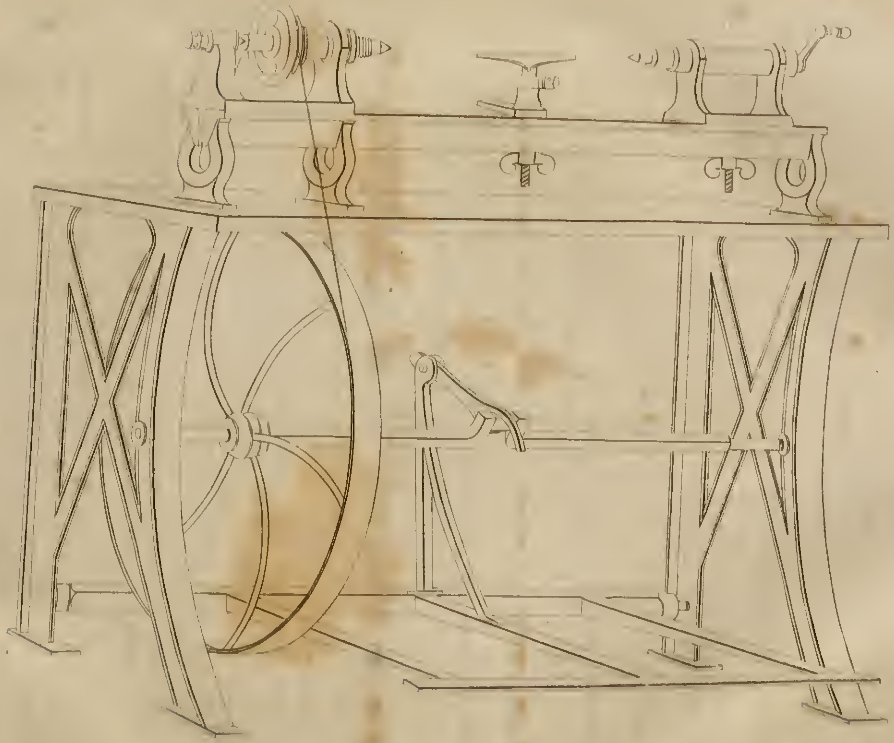
In the machine for pressing cotton; Philemon White, Chatham County, N. C. Feb. 19.

In the plough; Ryland Rodes, Charlotteville, Albemarle County, Va. Feb. 20.

In the percussion gun-lock; William A. Hart, Fredonia, N. Y. Feb. 20.

In the construction of locks for doors; John Brown, and George W. Robinson, Providence, R. I. Feb. 20.

In the manufacture of salt; Benajah Byington, Salina, N. Y. Feb. 21.



R. TYLER & CO'S. IMPROVED TURNING LATHE

In the construction of ships, and other vessels; Thomas W. Bakewell, Cincinnati, Ohio, Feb. 21.

In making pedestal feet for andirons; Edmund Smylie, New York, Feb. 22.

In the bogging machine; Squire Collins, Hillsdale, N. Y. Feb. 22.

In inlaying gold in Tortoise shell; Uriah Bailey, Newbury, Mass. Feb. 22.

In manufacturing suspenders; Abraham L. Van Horn, Philadelphia, Feb. 22.

In the pump for steam boilers; A. Judson, Sweden, N. Y. Feb. 23.

In making sofas, or portable bedsteads; Chester Johnson, Albany, N. Y. Feb. 24.

In the bee hive; Cuthbert Wiggins, Fayette County, Penn. Feb. 27.

In the mode of pressing paper; Ira White & Leonard Gale, Newbury, Vermont, Feb 28.

In the grist mill; Benjamin Overman, Greensborough, N. C. Feb. 28.

In the cutting of garments; J. G. Wilson, New York, Feb. 28.

In propelling vessels by water pressure; Elisha Fuller, North Providence, R. I. March 2.

In blowing and striking for blacksmiths; L. Hoyt and Ebenezer Pierre, Pulteney, N. Y. March 3.

In the making of seals for watches; S. Davis, H. & P. Rabbit & B. P. Grinnel, Providence, R. I. March 3.

In machinery for laying ropes; David Myerle, Philadelphia, March 3.

In making shovels; Oliver Ames, Easton, Bristol County, Mass. March 5.

In the mill for grinding apples; H. E. Paine, and S. H. Russel, Le Roy, Geauga County, Ohio, March 5.

In the making of gearing for mills; Charles Neer, Waterford, N. Y. March 6.

In the water wheel for saw mills; Thomas Shute, Tennessee, March 6.

In the making of artificial stone; Louis Mattley, Brooklyn, N. Y. March 7.

In a machine for cutting hard substances; John H. Hall, Harper's Ferry, Vir. March 7.

In the mode of engrafting teeth; Elijah A. Bigelow, Brandon, Vermont, March 8.

In wheel dampers for chimneys; James Riley and John Flanagan, Waynesburg, Penn. March 10.

In casting the feet of brass andirons; John Griffiths, New York, March 15.

In making hatter's cards; Joseph C. Seely, New York, March 15.

In the horizontal wind mill; John Reynolds, America, N. Y. March 15.

In the machine for cutting straw, &c.; Calvin Chamberlin, America, N. Y. March 15.

In an instrument called the wheelwright's assistant; Cyrus W Beach, Schoharie, N. Y. March 16.

In the longitudinal corn sheller; George E. Waring, Poundridge, N. Y. March 16.

In the mode of distilling Alcohol by steam; Anson & Norman Wolcott, Bloomfield, N. Y. March 19.

In a spring temple for weavers; A. Jenks, and J. Clewell, Holmesburg, near Philadelphia, March 19.

In the crusher and grist-mill; John G. Morse, Randolph County, N. C. March 20.

In the machine for making bricks; David Atchester, Vermont, March 21.

In pumping water out of ships by means of wind; Thomas Brownell, New York, March 23.

In the churn; Samuel L. Bagley, Hillsdale, N. Y. March 24.

In a twin plough; Noble G. Cryer, Wentworth, N. C. March 24.

In the domestic cooking stove; David Westfield, New York, March 24.

In the same; Joseph R. Page, Philadelphia, March 24.

In grinding and polishing hard and soft substances; Benjamin Green, Hartford, Vermont, March 27.

In the mode of preparing cotton roving for spinning; Gilbert Brewster, Poughkeepsie, N. Y. March 28.

In the pressing and lifting machine; Samuel Andrews, Bridgetown, Maine, March 28.

In the horse hay rake; Jeremiah Bailey, Philadelphia, March 30.

In a mode of obtaining power from certain fluids; Mark J. Brunnel, London, England, March 30.

In manufacturing shingles; Paul Hawes, Lockport, N. Y. March 30.

In a machine for trimming the edges of paper; John M'Clintie, Chambersburg, Penn. March 31.

In making watch keys; Joseph S. Davis, Providence, R. I. April 3.

In the manufacture of tobacco; J. Allen, Jr. and Charles Geoghegan, Richmond, Va. April 3.

In an instrument for working in wood; Jeremiah Bailey, Philadelphia, April 7.

In a machine for cutting tubs, buckets, &c. Jeremiah Bailey, Philadelphia, April 7.

In the homony machine; Roberts Campbell, Martinsburg, Va. April 9.

In the cider mill; Constant H. Wicks, Paris, N. Y. April 9.

In the machine for setting up hat bodies; Joseph Grant, Providence, R. I. April 10.

In the water wheel for steam boats; Robert L. Stevens, Hoboken, N. J. April 10.

In making tenons on spokes for wheels; David Sperry, Colchester, Conn. April 18.

In the spinning machine; Nathaniel Remington, Geneva, N. Y. April 21.

In all kinds of propelling machinery; William Staunton, Centre Township, Indiana, April 23.

In the turning lathe; William Patrick, Leverett, Mass. April 24.

In the steam engine; George Fleming, Goochland C. H. Va. April 24.

In preserving eggs, butter and lard; Thomas Edmundson, Pipe Creek, Md. April 26.

In the manufacturing of wool; John Goulding, Dedham, Mass. April 27.

In making clay tubes; John R. Rowell & Henry Wire, Fredericktown, Penn. May 10.

In the scraper, or team shovel; G. Davis, and J. Price, Lockport, N. Y. May 12.

In the steam engine; E. A. Lester, Boston, Mass. May 14.

In stocks; Joseph Towson, Baltimore, May 14.

In the mill for grinding paint; Allen Holcomb, Butternutts, N. Y. May 14.

In the mode of extracting oil by steam; David Dodge, Hamilton, Mass. May 14.

In marine rail ways, Joseph Webb, New York, May 14.

In a safety gate for canals; Jacob Van Dorn, Glen, Montgomery County, N. Y. May 14.

In the valve cock, for hydrants; Benjamin Stancliff, Philadelphia, May 15.

In the cotton press; Richard Jarnigan, Waynesborough, N. C. May 15.

In the horizontal piano forte; Thomas Loud, Philadelphia, May 15

In the employment of heated air, in aid of steam power; Minus Ward, Baltimore, May 15.

In funnel stoves; Hiram Wales, Randolph, Mass. May 18.

In the cast iron plough; Robert Sweeny, Warren County, Ohio, May 18.

In the machine for cleansing wheat, rye, &c. John Tyler, Claremont, N. H. May 18.

In carts for removing earth; Jeremiah Prince, Lockport, N. Y. May 18.

In the churn; Levi Rosencrans, Urbana, N. Y. May 19.

In the machine for crushing corn with the cob; S. K. Gauntt, Greenville, Tenn. May 25.

In a water-proof stiffening for hats; Stephen Hempstead, jr. Charles County, Md. May 25.

In the thrashing machine; M. Pennock, Kennet Square, Chester County, Penn. May 26.

In the mode of letting water on the water wheel; Robert & Thos. T. M'Culloch, Albemarle County, Va. May 26.

In the evolution and management of heat; Eliphalet Natt, Schenectady, N. Y. May 30.

In mills for grinding grain; Abraham Delap, and Avery Coe, Guilford, N. C. May 31.

In the machine for hulling and cleaning rice; J. Campbell, Winsboro, S. C. May 31.

ENGLISH PATENTS.

List of patents for New Inventions, which passed the Great Seal, in England, from May 26, *to July* 18, 1827.

To William John Hobson Hood, lieutenant in our royal navy, for his invention of certain improvements on pumps, or machinery for raising or forcing water; chiefly applicable to ships—Sealed 26th May.

To George Burges, for his invention of certain improvements in the construction of wheeled carriages, and wheels to be attached to the said carriages, or for other purposes—26th May.

To Thomas Clarke, carpet and worsted manufacturer, for his invention of certain improvements in manufacturing carpets—26th May.

To Malcolm Muir, for his invention of certain machinery for preparing board for flooring, and other similar purposes—1st June.

To John Were Clark, for his invention of an improved mode of attaching, fixing, or securing, the dead eyes to the channels and sides of ships or vessels—8th June.

To Joseph Cliseld Daniell, clothier, for his invention of certain improvements in preparing wire cards, and dressing woollen and other cloths—8th June.

To Charles Phillips, captain in our royal navy, for his invention of certain improvements on capstans—8th June.

To Hugh Evans, lieutenant in our royal marine corps, and William Robert Hale King, tin-plate worker, for their invention of a new table apparatus to promote the ease, comfort, and economy of persons at sea, or on nautical excursions—12th June.

To Thomas Don, millwright, and Andrew Smith, builder, for their invention and discovery of methods of making and constructing shutters and blinds of iron or steel, or any other metals or compositions thereof, and improved methods of constructing and fixing shutters and blinds of iron or steel, or any other metals or materials, and methods of uniting in shutters the double properties of shutters and blinds—15th June.

To Solomon Robinson, flax-dresser, for his invention of improvements in machinery for hackling or dressing and clearing hemp, flax, and tow—16th June.

To Lambert Dexter, Esq., in consequence of a communication made to him by a certain foreigner residing abroad, for an invention of certain improvements in machinery for the purpose of spinning wool, cotton, and other fibrous substances—16th June.

To Henry Raper, Esq. a rear admiral in our royal navy, for his having found out, or invented a new and improved system of signals, first for communicating by day, by the means of flags and pendants between ships at sea, or other objects far distant from each other; in which system the colours of the flags and pendants which have heretofore served to distinguish the signals one from another, and which by distance or other causes, are extremely subject to be mistaken, may be dispensed with altogether; and secondly, for communicating by night between ships at sea, and other objects far distant from each other, by the means of lights. · And which system of signals is more conspicuous, expeditious, and certain than any which has hitherto been employed for the like purpose—21st June.

To James Marshall, lieutenant in the royal navy, for his invention of improvements in mounting guns or cannons for sea or other service—26th June.

To John Felton, of Hinckley, machine maker, for his invention or having found out a machine for an expeditious and correct mode of giving a fine edge to knives, razors, scissors, and other cutting instruments—28th June.

To Thomas Fuller, of Bath, coachmaker, for his invention of certain improvements on wheel carriages—28th June.

To Walter Hancock, Engineer, for his invention of an improvement or improvements upon steam engines—4th July.

To William Wilson, hat manufacturer, for his having invented or found out the means or principle of extracting spirits and other solvents used in dissolving malleable gums of various kinds, and other articles employed for stiffening hats, hat bodies, bonnets, caps, and divers articles of merchandises, and converting such spirit (after rectification) into use—4th July.

To Rene Florentin Jenar, gentleman, for his invention of certain improvements in lamps—4th July.

To George Boulton, tailor, for his invention of an instrument, machine, or apparatus for writing, which he denominates a self-supplying pen—4th July.

To Thomas Sowerby, merchant, for his invention of certain improvements in the construction of ships' windlasses—4th July.

To Rene Florentin Jenar, gentleman, for his invention of a new method of filling up with metal or other suitable material the holes or interstices in wire gauze, or other similar substances which he denominates metallic linen—4th July.

To John Snelson Shenton, plumber and glazier, for his having invented or found out certain improvements in the mechanism of water closets—12th July.

To Edward Barnard Deeble, civil engineer, for his invention of a new construction or constructions, and combination or combinations of metallic blocks, for the purposes of forming caissons, jetties, piers, quays, embankments, light houses, foundations, walls, or such other erections to which the said metallic blocks may be applicable—12th July.

To Robert Vazie, civil engineer, for his invention of improvements in certain processes, utensils, apparatus, machinery, and operations applicable to the preparing, extracting, and preserving various articles of food, the component parts of which utensils, apparatus, and machinery, are of different dimensions, proportionate to the different uses in which they are employed, and may be separately applied in preparing, extracting, and preserving food, and in other useful purposes—12th July.

To William Church, of Birmingham, Esq. for his invention, and having found out certain improvements in apparatus for spinning fibrous substances—13th July.

To George Anthony Sharpe, Esq. for his invention of an improved table urn—18th July.

To Robert More, distiller, in consequence of communications made to him by certain foreigners residing abroad, and discoveries made by himself, for certain improvements in the process of preparing and cooling worts, or wash, from vegetable substances, for the production of spirits—18th July.

To Robert More, distiller, in consequence of communications made to him by certain foreigners residing abroad, and discoveries made by himself, for certain processes for rendering distillery refuse productive of spirits—18th July.

A list of patents granted by the French Government, from the first of January to the 31st of March, 1827.

To M. Calla, Engineer, Paris, for a new kind of corner stone, or boundary—5 years.

M. de Bourgoing, Paris, for the invention of a new reproductive art, called *Lithophanie*, applicable to every combination of opaque and transparent bodies—15 years.

Jaques Michel Labbaye, Paris, for an harmonic trumpet, with three ventilators, and plug keys—5 years.

Nicholas Louis Clairembourg, Rouen, for the invention of a liquid paste, for sharpening razors, and softening leather of all descriptions 5 years.

Risler, Brothers and Dixon, of Cernay, for the invention of a loom for weaving cotton, wool, flax, and silk, &c.—5 years.

Romain Desire Carillon, Paris, for a steam engine, with an inclined piston, stop, partial condenser, and metallic apparatus—5 years.

Hippolyte Brasseux, junior, Paris, for a seal with 100 mottoes, called the *Cachet Medailler*—5 years.

Messrs. Pierre Thomas Duret, junior, Antoine and Anthoine, of Paris, for a method of Paving ovens, by means of the free stone, vulgarly called *Pierre de Barbantine*—5 years.

Bernaud Chaussenot, Paris, for an apparatus for lighting up by means of *carburetted hydrogen gas*, obtained from a distillation of rosin, and other matters, liquid, as well as solid—10 years.

Jaques Boulet, Paris, for a preparation to be used in carding and combing wool, in order to lay the fibres straight—15 years.

Madame Susse, widow, (of the family of Aglae Reine Aube,) Paris, for a cylinder for stamping and marking drawings, borders, and figures, upon skins, and leather of all kinds—10 years.

Messrs. Beauvais, Camille, and D'Antremont, Paris, for a silk and woollen dressing machine—7 years.

Pierre Jaques Haize, Felix and Binet, Paris, for a safety valve for steam engines—5 years.

Charles Francois Derheims, Lyons, for a particular method of constructing steam boats, in shallow rivers, as well as in deep waters—5 years.

Francois Ambroise Mairet, of Fouteney, for a machine to make paper of any dimensions—5 years.

Jean Nautes Piquet, for a machine called a Polymetre, for giving the dimensions of different figures—5 years.

M. Ansman, Paris, for a comb with several rows of teeth and a handle—5 years.

Silvestre Vanboorick, Strasbourg, for a carriage with a moveable beam, and which cannot be overturned—10 years.

Pierre Castereau, Paris, for a table, lengthening by means of joints, instead of slides—5 years.

Claude Jean Baptiste Alexandre Berthault, Chalous sur Seine, for an impermeable cement—15 years.

Pierre Louis Guimberteaux, Paris, for a machine called a *Corbeau*, for carrying off or letting down any kind of materials—5 years.

Benjamin Rotch, Paris, for a machine for winding silk—15 years.

Sebastien Erard, Paris, for machinery adapted to pianos, and other purposes—15 years.

Jean Baptiste Tereygeol, Paris, for the construction of a mill for grinding flour, without mill-stones—15 years.

Toachim Rabier, Rennes, for a method of constructing wooden cylinders of all dimensions, adapted to the bellows of forges, and iron-foundries, and applicable to vats, and many other uses—10 years.

Alexis Bruno Bagnolt Gensoul, for a method of heating with economy of fuel, the pans used for winding off cotton balls—10 years.

George Pocock, Bristol, for a machine called the *Cerf-volant*, used for drawing carriages, and lifting weights, and which may also be used in navigation—10 years.

Louis Alexander Desire Hoyeau, Paris, for a machine for making clasps—15 years.

Simon Berard and James Wilkinson, for a bobbin and carriage, for spinning, stretching, and twisting silk, flax, hemp, wool, cotton, &c.—15 years.

M. Dietz, junior, Paris, for a piano of entirely new construction and mechanism—10 years.

Adrien Jean Baptiste Gourlier, Paris, for an iron rammer, called the *Fer Mobile Cylindrique*—5 years.

Claude Henri Poucet, Lyons, for a shuttle applicable to silks, &c. as well as cloth—5 years.

M. Nery, Paris, for an apparatus for preventing chimneys from smoking—5 years.

Honore Henri Nery, Paris, for a steam engine, with improved rotatory movement—10 years.

Michel Laurent Huet, Paris, for a transportable vapour bathing apparatus—5 years.

Pierre Tespaz, Paris, for an apparatus called the *Fumivore Vaporisateur Condensateur*, for condensing the vapour produced by the combustion of gas, oil, &c.—10 years.

M. De Montaignac, Bordeaux, for improvements in the making and trying of iron chain cables—5 years.

M. M. Portefais Brothers, Paris, for a dynamic lamp—5 years.

Risler, Brothers and Dixon, Paris, for a new invented loom called a *Mechoir*—10 years.

William Newton, London, for an apparatus called a *Califier and Refrigerator*, for heating and cooling fluids—15 years.

Miles Berry, London, for improvements in the machines for dressing cloths, &c.—15 years.

Francois Cave, Paris, for a machine with double levers, to cut out and stamp malleable metals—5 years.

Godefroy, Devillers, and Co., Lille, for a bobbin and shuttle for spinning flax, and other filaments—5 years.

Jean Antoine Finino, Paris, for a candlestick of bell-metal, with a driving bolt of one piece—5 years.

Francois Clemencean, Dourdan, for a machine for sifting wheat and grain—10 years.

Onesime Guiltotiere Poucet, for improvements in the shuttles employed for figured silk stuffs—10 years.

The Misses Josephine and Victoire Beauguillot, Caen, for an improved method of making the edge or ends of a piece of lace, &c.—5 years.

Charles Cunningham, London, for a machine for *making the heads of Pins*—10 years.

Marie Martin Philippe Mengin, and Jean, Alphonse Andre Francois Petit, Paris, for machines for making small nails, called *Pointes de Paris*—15 years.

Joseph Toul Carez, for a method of engraving in relief, called pantoglaphic—15 years.

M. Fichtenberg and Co., Paris, for various improvements in the fabrication of coloured paper, imitating granite, and marble, and for a method of glazing them—10 years.

M. Sayaresse and Co., Paris, for a method of making harmonic cords without knots, and of one length for each instrument—5 years.

Antoine Nicholas Duguet, Paris, for a machine called the *Petrin Mecanique* for kneading—15 years.

Touron Felix Lebrun, Paris, for a machine for making lint from old linen, &c.—10 years.

Parfuit Modeste Carpentier, Paris, for a mechanical bed and arm chair, with bandages—15 years.

Auguste Allien, Paris, for a liquid called *Marjolame*, for taking out grease spots—5 years.

Jean Kettenhoven, Paris, for sandals composed of metal—10 years.

Jean Marie Cordier, Beziers, for a process for extracting the oil, wine, or sugar, from fruits, by means of circular plates, and an hydraulic machine for presses—5 years.

Christophe, Francois and Martin Dillemann, and Jean Michel Reinhard, Strasbourg, for inventing a horizontal movement, and vertical pressure upon bobbins, for cotton spinning—10 years.

Petit Comoune and Elbeuf Caplain, senior and junior, for a machine for making brads—5 years.

Pierre Bonillon, junior, Limoges, for steam vessels without or with condensers, of all pressures and expansion—10 years.

Dominique Marie Houlet, and Silvain Riverin, Paris, for a method of employing waste pieces of whalebone, in making buttons of all colours—5 years.

Laurent Blard, Paris, for a machine for stamping and closing at the same time the slides and rings called *bellieres*, used in chains for reticles, watches, &c.—5 years.

Anthelme Junin, Paris, for a method of making diamond cut, washed and gilt headed nails—5 years.

Claude Henri Poucet, Lyons, for a shuttle for weaving stuffs and cloths—5 years.

Charles Rule, Paris, for a method of extracting gas from oily, resinous, or bituminous substances, with great economy and expedition—15 years.

Jean Petit, and Meugin Montalaire, for machines for making brads, called *Pointes Depans*—15 years.

Jean Baptiste Chauvelot, Dijon, for a machine for sifting corn, removing the shoots from malt, and which, with a little alteration, may be used also as a bolting machine—5 years.

Jean Courad Fischer, junior, Paris, for a kind of steel, called an *Acier Meteorique*—15 years.

Jean Thomas Hutter, Lyons, for a mechanical oven, for glass works—5 years.

Charles Cote, Lyons, for a piano with keys placed in the cords, and for improvements in the trimming of the hammers in all kinds of pianos—5 years.

Duhelles Jaques, Jean Pilot, and Louis Kerever, Morlaix, for a method of making common and hydraulic lime of great strength—10 years.

M. Lepine, Paris, for a gas generating lamp called a *gaza-lampe*—10 years.

William Furnival, of Ashton, for a new apparatus for making salt, which may be removed from place to place—15 years.

Cazalat Antoine Galy, Paris, for a percussion gun and its charge—10 years.

M. Fortier, Paris, for a cast iron stove, for the circulation of warm air—5 years.

Jean Joseph Allard, for a self-supplying lamp—10 years.

Devillez Bodson and Son, Bazeilles, for a machine for making handles for frying pans—10 years.

Cazalat Antoine Galy, and Jules Joseph Dubain, Paris, for the invention of a propelling power, acting without machinery, to take the place of steam in trading vessels, and insubmersible fire ships—10 years.

Eugine Valentia Ledoux, and Louis Etienne Herhan, Paris, for a new invented mould for casting types, and a machine for making grooves applicable to casting—15 years.

NOTICES.

To Subscribers.—A work like the Franklin Journal, which is distributed in nearly every state in the Union, must depend for its continuance, upon the punctuality of individuals who cannot be personally called upon for their subscriptions. Hitherto, neither the publisher or the Editor, has been compensated for his services, and although it is very gratifying to aid in the diffusion of information through our common country, the privilege of so doing may be purchased at too dear a rate. Hereafter, we shall prune and lop, without hesitation, until we have removed all those branches which bear no fruit themselves, and injure those which do.

Some subscribers have objected to payment in advance, because they are without security that the work will be continued; this sort of objection has been made by several who were formerly subscribers to the 'American Mechanics' Magazine,' published in New York. The Editor of the Franklin Journal has suffered much loss, in consequence of the agreement made with the proprietors of the former work, from whom their subscription list was purchased, and who afterwards failed to complete the volume, for which many of its patrons had paid. There is no danger of a similar termination in the present case, for although we have not become wealthy by the aid of the Journal, we are in no danger of bankruptcy; and we are not anxious to trust those who are unwilling to trust us.

Delay of the present number.—It has not been in the power of the printer, to complete this number until long after the time at which it was due, and it is probable that the next, also, will be somewhat retarded. A fire in a very extensive printing office, produces a disarrangement which it is a work of much time to correct.

Essays on Lithography.—The last three numbers of the *Journal des Connaissances Usuelles*, have not contained a continuation of these essays; they will probably be resumed in the next. We wish to complete them before offering some further information on the same subject, of which we are possessed. Our design is to make this subject as complete as possible. We are much gratified in being able to state, that Messrs. Carey and Lea of this city, have now a press at work; the measure of success which has already attended their efforts, and their known enterprise and perseverance, are sufficient guarantees that the business will be finally established.

Correspondents.—We have several communications on hand, some of which, though not suitable for publication, suggest topics upon which we intend to make observations; though we are compelled to delay, we will not finally neglect them.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS,

Internal Improvements, and General Science.

FEBRUARY, 1828.

FRANKLIN INSTITUTE.

Philadelphia, January 17th, 1828.

The Sixteenth Quarterly Meeting of the Franklin Institute, was held in the Hall, James Ronaldson, President, in the chair.

The report of the Board of Managers, and also, the report of the Treasurer, were read, and accepted.

On motion, Resolved, That the report of the Board of Managers be published in the Franklin Journal, and in the public papers.

Resolved, That the reading of the names of those members who have not paid their dues, be postponed until the next Quarterly Meeting.

Resolved, That the President be requested to present the thanks of the Institute to Mr. Samuel V. Merrick, Treasurer, for the very able manner in which he has performed the duties of that office.

The Tellers reported the following gentlemen, as duly elected officers of the Institute, for the ensuing year.

Officers for the year 1828.

President—James Ronaldson.
Vice-Presidents—Mathew Carey, Thomas Fletcher.
Corresponding Secretary—Isaac Hays.
Recording Secretary—Thomas P. Jones.
Treasurer—Samuel V. Merrick.

Managers.

John Harrison,	Samuel J. Robbins,
Abraham Miller,	Isaiah Lukens,

Adam Ramage,
James M'Alpin,
Isaac B. Garrigues,
William S. Warder,
A. G. Ralston,
Rufus Tyler,
John Struthers,
John O'Neil,
M. W. Baldwin,
Joseph H. Schreiner,
William Strickland,
Henry Horn,
M. D. Lewis,
W. Rowland,
Jacob Souder,
Charles H. White,
G. Emerson,
George Fox,
W. Stevenson,
Andrew Young.

The Sixteenth Quarterly (Fourth Annual) Report of the Board of Managers.

PHILADELPHIA, JANUARY 17, 1828.

The Board of Managers of the Franklin Institute of the State of Pennsylvania, respectfully offer to the general meeting, their Sixteenth Quarterly report; containing an exhibition of their proceedings during the three months with which the period of their services terminates.

In taking a retrospective view of what has been accomplished by the Institute, during the four years which it has existed, ample cause of felicitation presents itself to those who have laboured for its support. That errors have been committed, in the prosecution of plans which were altogether novel to us, will be readily conceded; but if, in some points, we have attained less than the founders of the Institution anticipated, we have, in others, far transcended the hopes of the most sanguine; and the Board believe, that a wise and prudent course, will insure to the Franklin Institute, one of the highest stations among the popular institutions of our country.

In previous reports the corrective measures which had been adopted respecting the admission of youths to the lectures, and the resolution to issue tickets for ladies, have been made known. The Board have now the satisfaction of stating that these plans have been carried into effect, and that the anticipated advantages have been fully attained. The youths attending, nearly one hundred in number, have conducted themselves in a very decorous manner, and have evinced a commendable anxiety for the attainment of knowledge. Tickets have been procured by between forty and fifty ladies, who, notwithstanding the general inclemency of the weather, have attended with the utmost regularity; and have, undoubtedly, largely contributed, by the influence of their presence, to the establishment of that perfect decorum which was so much to be desired.

The courses of lectures on Mechanics and Chemistry commenced at the usual period, have been fully attended, and are believed to be well adapted, both from the nature of the subjects chosen, and the mode of treating them, to furnish the skilful mechanic and manufacturer, with that scientific knowledge, which will enable him to attain the highest degree of perfection in his art. No volunteer lectures have been delivered during the present season, nor has any proposition been hitherto made with that view.

Since the last Quarterly Meeting, the Board have received the resignation of the chair of Chemistry, by Professor Keating, who was one of the most active of the founders, and most zealous and efficient of the supporters, of the Institute. It was the ardent wish of the Board that he should retain the Professorship, whilst any prospect remained of his early return to the United States; but as his present engagements have removed the hope which had been entertained, his resignation was necessarily accepted. Whilst the Board regret the loss of those services which were felt in every department, they have reason to congratulate the Institute upon the provisional fulfilment of the duties of the Professorship, by a gentleman, eminently qualified by his talents, and his extensive knowledge in the science of Chemistry, to advance the important objects for which it was established.

Dr. Godman, who has heretofore filled the chair of Natural History, has, also, in consequence of his removal from the city, tendered his resignation, which has been accepted. This Professorship was not one of those which it was originally intended to establish, as the subject is but remotely connected with the practical objects, which were deemed, in the first instance, most important to be embraced; but the liberal propositions of the late incumbent, induced the Board to make the appointment; an act which was fully justified by the interest which the course of lectures excited, and which, by the scientific acquirements, and popular talents of the lecturer, was sustained throughout.

Peter A. Browne, Esq. who has fulfilled the arduous duties of Corresponding Secretary, ever since the formation of the Institute, has, in consequence of the state of his health, and the pressure of other avocations, declined a re-election to that office. The important and lasting benefits which have been secured to the Institute by the exertions of this gentleman, will not be forgotten, as they are enrolled amongst its archives. Another faithful servant of the Institute, Mr. Hervey Lewis, has also been compelled to withdraw from the Board, on account of indisposition; his colleagues feel the loss of the aid of so useful a coadjutor, and most sincerely regret that it has been produced by such a cause.

The Committee of Instruction not having made a report, respecting the High School, since the opening of the present session, the Board is unable to do more than to state that its operations are still continued, and, it is believed, with the anticipated advantages to the pupils. It has not yet been found possible to obtain apartments adapted to its use, out of the Hall of the Institute; this, however, it is designed to accomplish, as it is very desirable that the rooms should be appropriated to the reception and display of models, apparatus, minerals, and other articles; and likewise that they should be occupied by the library, and as reading rooms.

The Board, desirous of promoting every object calculated to diffuse information among the operative classes, made a tender of such rooms as they had at their disposal, and of the use of the books belonging to the Institute, free of charge, to 'The Mechanics' Library Company of Philadelphia.' This offer, it is believed, they have not thought proper to accept; for although no final answer has been obtained, such a length of time has elapsed, since the last communication was received from them, as to warrant this conclusion.

The vacancy in the Drawing School, occasioned by the resignation of Mr. Haviland, was filled by the appointment of Mr. George Strickland, who, in conjunction with Mr. Hugh Bridport, has attended to the duties of that department, since the commencement of the session. The number of pupils in this school is less than formerly; and it is much to be regretted, that Mechanics, and others, do not more frequently avail themselves of the great facilities offered, in the smallness of the charge, and the talents of the teachers, for acquiring skill in an art so extensively useful.

Application has been made by the Philadelphia Sunday School Union, for the use of the Hall on the Sabbath day, for the moral and religious instruction of apprentices; and as this object is perfectly compatible, and indeed, in unison with those of the Institute, it has been determined to let it for that purpose, at a very moderate rent.

The Treasurer's account, which is herewith presented, exhibits a balance, in hand, of $16 $\frac{3}{100}$. It appears, also, that there is an outstanding balance, due from members, amounting to $874 $\frac{50}{100}$, and as it is probable that some considerable portion of this, may hereafter be collected, the Treasurer has recommended that the reading of the names of delinquents, be postponed until the next meeting of the Institute.

By the report of the Managers of the Sinking Fund, it appears, that the sum of $1319, has been appropriated to that object, during the last year.

Accepted by the Board,

Thomas P. Jones, *Secretary.*

On Casting, Grinding, and Polishing Speculums, for Reflecting Telescopes, Microscopes, &c. By the Rev. John Edwards, B. A.

[Continued from p. 46.]

As the manner of working or figuring the metal upon the first, and indeed upon all the succeeding tools, is taught in Dr. Smith's Optics, or the before mentioned volume of the Philosophical Transactions, I shall refer my reader to those publications, as I only mean to give my own improvements. When the metal is brought to a true figure, it must be taken to a convex tool, formed with some stones from a place called Edgedon, in Shropshire, situated between Ludlow and Bishop's Castle. These stones, or hones, are of a fine grain, and will easily cut the metal, and bring it to a fine face. Indeed, the blue hones* used in general by the opticians for this purpose, will scarcely touch the metal, and it will be a laborious undertaking to bring the metal to a fine face, so as to take out all the breaks up from the emery, by the common blue hones. By means, however, of the above mentioned stones, they may be easily ground and truly figured. The bed of stones should be of a circular figure, and but very little larger than the metal intended to be figured upon it, viz. about two-tenths of an inch, but not more for a speculum of four or five inches in diameter. If the tool is made considerably larger than the metal, it will grind the metal perpetually into a larger sphere, and by no means of a good figure: if the metal and tool are of the same size exactly, the metal will work truly spherical; but it is apt to shorten its focus less and less, unless the metal and tool are worked alternately upwards. It had, therefore, better be made a little† larger than the mirror, when it will not alter its focus. Too much water should not be used at a time upon the hone pavement, or the figure will be very bad, which may easily be seen by the face of the metal appearing of different degrees of brightness, in different parts of it. When the metal is brought to a very fine face and figure by the bed of stones, it is ready to receive a polish: but before I shall give any directions with regard to the manner of polishing it, I must mention a circumstance or two, I had inadvertently passed over. The metal must not be cast too thick, or it will never take the parabolic figure intended to be given to it. The best proportion I have found for this purpose, is that a metal of four inches and a half diameter, and eighteen inches focus, should be four-tenths of an inch thick at the edge of it: the back of the mirror should be convex, to strengthen it, and to cause it to spring, and adhere to the polisher, uniformly. Its convexity should be equal to its concavity on the face, that the metal may be every where of an equal thickness. The handle should be made of lead, of the same convexity and concavity as the metal, its thickness about double that of the metal, and its diameter three-fourths of that of the speculum; it should have a hole in the middle, with a copper or iron screw on it, so as to put it together, with the mirror, to which it is fastened with pitch, on a collar lathe, in order to smooth and finish the edge of the metal, which may be done by holding a fine file to it when in the lathe at the first, and afterwards one of the above mentioned stones.

Of polishing the Metal, and giving it the true parabolic Figure.

The rough grinder, of an *elliptical* form, is now to be covered with common pitch. I generally make my own pitch, by boiling tar in a ladle or crucible, over a very slow fire, till it becomes of the consistence I require; for a great nicety is required in the degree of the hardness of the pitch. The harder the pitch is, the better figure it will give to the metal, as it does not alter its figure in working as soft pitch does; besides, the metal will acquire a lustre upon a polisher moderately hard, so as to show objects reflected upon it, as vivid and as near their natural colour as possible; but if the pitch is too soft, some of its finest particles will always adhere to the face of the metal, and form a very fine and thin cuticle, or covering, upon its surface. This circumstance is rendered very evident, by viewing any white object in the metal, (a sheet of white paper for example,) when that fine cuticle or thin surface of the pitch upon the speculum, will cause it to show the object of a dingy brown colour, and not of its genuine whiteness. Pitch may be easily made harder by adding a proper quantity of rosin. I often use equal quantities of pitch and rosin, so as to make the mixture just so hard when cold, as to receive an impression from a moderate pressure of my nail. A polisher made with pitch and rosin has this advantage, viz. though it is hard, yet it is not so brittle as when pitch only is used, and made hard by boiling it, and consequently not so liable to break or chip off at the edges, and thereby scratch the metal. Pour the melted pitch and rosin, when pretty cool, from the crucible upon the elliptic tool,* so as to cover it every where, when spread upon it with an iron spatula, about the thickness of a half-crown piece. If the covering is too thin, it will continually alter its figure by the heat it acquires in working the metal upon it, and thereby give a bad figure also to the speculum. When it is somewhat cool, lay a piece of writing paper upon the surface of the pitch, press the face of the mirror upon it, and you will find the polisher will be nearly figured to the form of the speculum. If it has not taken an exact figure every where, which would appear by the fine marks of the grain of the paper upon the pitch, gently warm the surface of the pitch, and repeat the operation as before, until you have formed it of the exact† figure of the metal. With a penknife take away, now, all the superfluous pitch from the edge of the polisher, and with a conical piece of wood form the hole in the middle accurately round: in other words, let the pitchy surface be every where of the exact size, and shape, as the lead tool, which is under it. It may be necessary to mention, that the hole in the middle of the polisher should go quite through the tool, (for a particular reason,) and should be made of the same size, or somewhat less, than the hole in the middle of the speculum.

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* Should any one, however, make use of the common blue hones, he should use as little water as possible when the metal is put upon them, as they will cut much better when barely wet, than if much water is used upon their face.

† About one-twentieth part greater in diameter.

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* The elliptic tool must be made pretty warm, or the pitch will not adhere to it.

† When the polisher is brought to its true figure, gently warm it at the fire, and with the edge of a knife, divide it into several squares, by pressing the edge of the knife gently upon the pitch; these squares, by receiving the small portion of the metal that works off it in polishing, will cause the figure of the speculum to be more correct, than if no such squares had been made. The polisher may also be formed without the writing paper, by dipping the mirror into cold water, and afterwards pressing it upon the surface of the pitch, (when it is somewhat cool,) and by repeating this operation till it has taken the exact figure of the metal.

This is a necessary caution, and indeed I have always found that small mirrors, without any hole in the middle, will polish much better, and the figure will be more correct, if the polisher has a hole in the middle. The powder I prefer above all others, to give a most exquisite lustre, is *colcothar of vitriol*, and not *putty*. *Putty* gives metals a white lustre, or as workmen call it, a silver hue; but good colcothar of vitriol will polish with a very fine and high black lustre, so as to give the metal finished with it, the complexion of polished steel. To know if the colcothar of vitriol is good, put some of it into your mouth, and if you find it dissolves away it is good; but if you find it hard, and crunch between your teeth, then it is bad, and not well burned. Good colcothar of vitriol is of a deep red, or a deep purple colour, and is soft and oily when rubbed between the fingers; bad colcothar of vitriol is of a light red colour, and feels harsh and gritty. The colcothar of vitriol should be levigated between two surfaces of polished steel, and wrought with a little water; when it is worked dry, you may add a little more water, to carry it lower down, to what degree you please. When the colcothar of vitriol has been wrought dry three or four times, it will acquire a black colour, and will be low enough, or sufficiently fine, to give an exquisite lustre. This levigated colcothar of vitriol I put in a small phial, and pour some water upon it, and afterwards I use it for polishing the metals, in the same manner that washed putty is always directed to be made use of for that purpose. I always put on a large quantity of washed colcothar of vitriol at once, so as to saturate the pitch, and form a fine coating of the colcothar, and very rarely make use of a second application. If a second or third application of colcothar should be found necessary to bring the metal to a high lustre, or to take out any scratches upon its face, use it very sparingly, or you will destroy the polish you have already attained. When the metal is nearly polished, it will always generate some black mud upon the surface of the mirror, and also upon the tool. Wipe it now away from the face of the metal with some very soft wash leather; though, if too much of this mud be taken away, it will not polish so well. Indeed, a little experience in these matters will better suffice, than a volume written upon the subject.

In regard to the *parabolic figure* to be given to the metal, no particular caution is required in the polishing; the *elliptical tool* will always cause the speculum to work into an accurate parabolical figure, supposing the transverse and conjugate diameters bear the true proportion to each other, and the metal is not too thick to prevent it always from adhering firmly and uniformly to the polisher. Should the pitch prove too soft, it will give way, and alter the figure a little. This circumstance will render the figure of the mirror sometimes a small degree short of the parabola, and sometimes a very little beyond it; but by a little perseverance the correct figure is very easily acquired. I could very easily give the reader the reason, why an *elliptical tool* of a proper proportion will always give a parabolical figure; and if the transverse diameter is increased, it will then always give an hyperbolical figure; but as I am writing upon the practical part of making reflecting telescopes, and not the theory, I will not offend his patience. To convince any one of the certainty of my assertions, let him polish a metal of $2\frac{1}{2}$ inches diameter, and $9\frac{1}{2}$ inches focus, upon an *elliptical tool*, whose diameters are $2\frac{1}{2}$ and 3 inches; and I can assert, he will always find the metal, when polished, (if it is not too thick,) beyond the parabola, or it will always prove hyperbolical. If he polishes it upon a *circular* tool in the common way, with cross strokes in every direction possible, using first a few round strokes every time he changes his position, he will find it always prove spherical, and consequently *short* of the parabola. A very little experience in these matters, will convince any one of the ease and certainty of giving the great speculum a parabolic figure, by polishing it in a common manner only with cross strokes in every possible direction, upon an *elliptical tool* of the proper dimensions, in which, for common foci and apertures, viz. $2\frac{1}{2}$ to $9\frac{1}{2}$ focus, or 3,8 inches in diameter to 18 inches focus, the diameters should be 10 to 9. The shortest diameter of the ellipse being accurately the same as the diameter of the metal, and the longest diameter of the ellipse to the shortest diameter, as 10 to 9.

[TO BE CONTINUED.]

On the Colours obtained from the Metallic Oxides, and fixed by Fusion on different Vitreous Bodies; abstracted from an essay on that subject. By ALEXANDER BROGNIART, *Director of the National Manufactory of Porcelain at Sevres, in France.*

THE art of employing metallic oxides for colouring by fusion different vitreous matters, is of very great antiquity: every body knows that the ancients manufactured coloured glass and enamel, and that this art was practised in particular by the Egyptians, the first people who in this manner imitated precious stones.

The practice of this art in modern times has been carried to a high degree of perfection: but the theory has been neglected; it is almost the only one of the chemical arts in which no attempt has yet been made to apply the new principles of that science.

The very numerous works which treat on the method of preparing and applying vitrifiable metallic colours, either contain no theory, and consequently no general principles, or give only explanations founded on hypothesis, often ridiculous, which formerly composed the theory of chemistry.

I have thought it might be of utility to the arts, and that it was the duty of the national manufactory of Sevres, to make known the pretended secret of the composition of those porcelain colours which are unalterable in the fire.

My object is not to give a detailed account of the exact composition of all the vitrifiable colours; such a labour cannot be the subject of a single memoir.

It is well known, that all vitrifiable colours have for their basis metallic oxides; but all the metallic oxides are not proper for this purpose: besides, as they are not vitrifiable by themselves, they can scarcely ever be employed alone.

Highly volatile oxides, and those which adhere little to the great quantity of oxygen they contain, either cannot be employed in any manner, as the oxide of mercury and that of arsenic, or are employed only as agents. The colour they present cannot be depended on, since they must lose it in the slightest heat, by losing a part of their oxygen: such are the puce coloured and red oxides of lead, the yellow oxide of gold, &c.

Oxides in which the proportions of oxygen are susceptible of varying with too much facility, are rarely employed: the oxide of iron, though black, is never employed for that colour; and the green oxide of copper is, under many circumstances, very uncertain.

I have said, that alone, oxides are not susceptible of fusion: however, as they are destined to be applied in thin strata on vitrifiable substances, they may be attached to them by a violent heat. But, except the oxides of lead and bismuth, they would give only dull colours. The violent heat, often necessary to fix them, would change or totally destroy the colours. A flux then is added to all metallic oxides.

This flux is glass, lead, and silex; glass of borax, or a mixture of both.

Its general effect is, to give splendour to the colours after their fusion; to fix them on the article which is painted, by promoting, more or less, the softening of its surface; to envelop the metallic oxides, and to preserve their colour by sheltering them from the contact of the air: in a word, to facilitate the fusion of the colour at a low temperature not capable of destroying it.

Metallic oxides are employed sometimes directly, and merely mixed with their flux, without being previously fused with it. In many circumstances, oxides are fused previously with their flux, and afterwards ground. In speaking of colours in particular, I shall point out those which experience this kind of fusion.

I shall speak here only of the application of metallic colours to vitreous bodies or to vitreous surfaces.

These bodies may be divided into three classes, very distinct by the nature of the substances which compose them, the effects produced on them by the colours, and the changes they experience. These classes are:

1st. Enamel, soft porcelain, and all crusts, enamels, or glass, that contain lead in a notable quantity.

2nd. Hard porcelain, or porcelain which has a crust of feld-spar.

3d. Glass in the composition of which no lead enters, such as common window glass.

It is well known, that enamel is glass rendered opaque by the oxide of tin, and exceedingly fusible by the oxide of lead. It is the oxide of lead, in particular, contained in it, that gives it properties very different from those of the other excipients of metallic colours. Thus all glass and glazing that contain lead will participate in the properties of enamel; and what we shall say of one may be applied to the rest with very trifling differences. Such are the white and transparent glazing of stone ware, and the glazing of porcelain called *soft glazing.*

This porcelain, which was the first made in France, and particularly at Sevres, where it was a long time manufactured almost exclusively, has for its base a vitreous frit, rendered almost opaque, and susceptible of being worked with clay, and is glazed with an exceedingly diaphanous glass, into the composition of which there enters a great deal of lead.

The colours employed in it are those which serve for painting in enamel: consequently, whatever changes these colours experience on enamel, they must experience on this kind of porcelain, since the causes of this change, which we shall mention hereafter, are the same.

Enamel or soft porcelain colours require less flux than others, because the glass on which they are applied becomes sufficiently soft to be penetrated by them. This flux may be either glass of lead and pure silex, called *rocaille*, or the same glass mixed with borax.

Montamy asserts, that glass of lead ought to be banished from among the enamel fluxes; and he employs only borax. He then dilutes his colours in a volatile oil.

On the other hand, the painters of the manufactory of Sevres, employ only colours without borax, because they dilute them in gum; and borax does not dilute well in that substance. I have found that both methods are equally good; and it is certain that Montamy was wrong to exclude fluxes of lead, since they are daily employed without any inconvenience, and as they even render the application of colours easier.

I have said that in the baking of these colours, the crust, softened by the fire, suffers itself to be easily penetrated by them. This is the first cause of the change which they experience. By mixing with the crust they become weaker, and the first heat changes a figure which appeared to be finished, into a very light sketch.

The oxide of lead which the crust contains, is a second, but much more powerful cause of the considerable changes which colours experience. The destructive action which that metal exercises chiefly on iron reds, is singularly remarkable. I shall soon give an account of some experiments, which prove it in a very evident manner.

It has been already seen, that the two principal causes of the changes, which colours on enamel and soft porcelain, are susceptible of experiencing, do not depend in any manner on the composition of these colours, but on the nature of the glass to which they are applied. When it is said, that the colours of porcelain change in a considerable degree, it ought to be added, that it is those of soft porcelain; a kind almost neglected.

It follows from what has been said, that painting on soft porcelain has need of being several times retouched, and of several heats, in order that it may be carried to the necessary degree of strength. These paintings have always a certain faintness; but they are constantly more brilliant, and they never are attended with the inconvenience of detaching themselves in scales.

Hard porcelain, according to the division which I have established, is the second sort of excipient of metallic colours. This porcelain, as is well known, has for its basis a very white clay, called *kaolin*, mixed with a siliceous and calcareous flux, and for its covering, feld-spar fused without an atom of lead.

This porcelain, which is that of Saxony, is much newer at Sevres than the soft porcelain. The colours applied to it are of two kinds: the first, destined to represent different objects, are baked in a heat very inferior to that necessary for baking porcelain. They are exceedingly numerous and varied.

The others, destined to be fused in the same heat as that which bakes porcelain, lay themselves flat, and are much less numerous.

The colours of painting are made nearly like those destined for soft porcelain; they only contain more flux. Their flux is composed of glass of lead, called *rocaille*, and borax.

When porcelain is exposed to heat, in order to bake the colours, the covering of feld-spar dilates itself and opens its pores, but does not become soft: as the colours do not penetrate it, they experience none of those changes which they undergo on soft porcelain. It must, however, be said, that they lose a little of their intensity, by acquiring that transparency which is given to them by fusion.

One of the greatest inconveniences of these colours, especially in the manufactory of Sevres, is the facility with which they scale off, when exposed several times in the fire.

This inconvenience is observed more at Sevres than any where else, because it depends on the solidity and infusibility of the porcelain manufactured in that establishment. But these are qualities which make it much longer resist alternations of heat and cold, and which give to its paste a more striking whiteness. Paris porcelain, on the other hand, being more vitreous, more transparent, and bluer, often cracks when boiling liquors are put into it.

To remedy this defect without altering the quality of the paste, I was of opinion, that the crust only ought to be softened, by introducing into it more siliceous or calcareous flux, according to the nature of the feld-spar. This method has succeeded; and for about a year past, the colours might be exposed two or three times to the fire without scaling, if not overcharged with flux, and if not laid on too thick. It has been remarked, that soda and potash introduced into the colours make them scale; they are, therefore, never used as fluxes. It is found that these alkalies, by becoming volatilized, abandon the colour, which when alone, cannot form an adhesion with the crust.

The third sort of excipient of vitrifiable metallic colours, is glass without lead.

The application of these colours to glass, constitutes painting on glass; an art very much practised some centuries ago, and which was supposed to be lost, because out of fashion; but it has too direct a dependence on painting in enamel and porcelain, to be entirely lost. Besides, a description of it may be found in a very great number of works.

The limits of a memoir will not allow me to enter into historical details respecting the art of painting on glass: a full history of it has been given in the work of Leviel. The matters and fluxes which enter into the composition of the colours employed on glass, are, in general, the same as those applied to porcelain. Neither of them differ but in their proportions; but there are a great number of enamel, or porcelain colours, which cannot be applied to glass, where they are deprived of the white ground which serves to give them relief. When seen by refraction, several of them entirely change their tone, and assume a dirty dint, which can be of no use: we shall make them known when we come to treat of colours in particular. Those which can be employed on this body, change sometimes in baking, and acquire a great transparency. In general, they are not beautiful; but, when placed between the light and the eye, they then seem to answer the only object that can be proposed in painting on glass.

The baking plates of painted glass, presents more difficulties than might be supposed. Care must be taken not to disfigure the piece, or alter the colours: all the works we have read recommend a bed of gypsum. This method has sometimes succeeded; but the glass, for the most part, becomes white and full of cracks. It appears, that glass too alkaline, (and alkalies are the most common in white glass) suffers itself to be attacked when warm, by the sulphuric acid of the sulphate of lime. We were able easily to bake pieces of glass much larger than those before painted, by placing them on very straight plates of earth, or of soft porcelain.

Of Colours in particular.

After collecting the general phenomena exhibited by each class of vitrifiable colours, considered in regard to the body on which they are applied, I must make known the most interesting particular phenomena, exhibited by each principal kind of colours employed on soft porcelain, and glass, in a porcelain furnace.

Of Reds, Purples, and Violets, made from Gold.

Carmine red, is obtained by the purple precipitate of Cassius: it is mixed with about six parts of its flux; and this mixture is employed directly, without being fused. It is then of a dirty violet, but, by baking, it acquires a beautiful red carmine colour: it is, however, exceedingly delicate; a little too much heat and carbonaceous vapours easily spoil it. On this account, it is more beautiful when baked with charcoal than with wood.

This colour, and the purple, which is very little different, as well as all the shades obtained from it, by mixing it with other colours, really change on all porcelain, and in every hand. But it is the only one that changes on hard porcelain. Its place may be supplied by a rose colour from iron, which does not change; so that by suppressing the. carmine made with gold, and substituting for it the rose oxide of iron, here alluded to, you may exhibit a palette composed of colours, none of which change in a remarkable manner. This rose-coloured oxide of iron has been long known; but it was not employed on enamel, because, on that substance it changes too much. As the painters on enamel, however, have become the painters on porcelain, they have preserved their ancient method.

It might be believed, that by first reducing to a vitreous matter the colour called *carmine*, already mixed with its flux, it might be made to assume its last tint. But the heat necessary to fuse this vitreous mass destroys the red colour, as I have experienced. Besides, it is remarked that, to obtain this colour very beautiful, it must be exposed to the fire as few times as possible.

Red, Rose, and Brown Colours extracted from Iron.

These colours are made from red oxide of iron, prepared with nitric acid. These oxides are further calcined, by keeping them exposed to the action of heat. If heated too much, they pass to brown.

Their flux is composed of borax, sand, and minium, in small quantity.

These oxides give rose and red colours, capable of supplying the place of the same colours made with oxide of gold. When properly employed, on hard porcelain, they do not change at all. I have caused roses to be painted with these colours, and found no difference between the baked flower, and that not baked, except what might be expected to result from the brilliancy given to colours by fusion.

These colours may be employed indiscriminately, either previously fused, or not fused.

The composition of them is the same, both for soft porcelain and for glass. They do not change on the latter; but on soft porcelain, they disappear almost entirely, on the first exposure to heat, and to make any thing remain, they must be employed very deep.

This singular effect must be ascribed to the presence of lead in the crust or glazing. I assured myself of this, by a very simple experiment. I placed this colour on window glass, and, having exposed it to a strong baking, it did not change.

Yellows.

Yellows are colours which require a great deal of care in the fabrication, on account of the lead which they contain, and which, approaching sometimes to the metallic state, produces on them black spots.

The yellows for hard and soft porcelain are the same: they are composed of the oxide of lead, white oxide of antimony, and sand.

Oxide of tin is sometimes mixed with them; and when it is required to have them livelier, and nearer the colour *du souci*, red oxide of iron is added, the too great redness of which, is dissipated in the previous fusion to which they are exposed, by the action of the lead contained in this yellow. These colours when once made, never change: they disappear, however, almost entirely when exposed to a porcelain heat.

These yellows cannot be applied to glass: they are too opaque and dirty. That employed by the old painters on glass, has, on the contrary, a beautiful transparency, is exceedingly brilliant, and of a colour which approaches near to that of gold. The processes which they gave, clearly showed that silver formed part of their composition; but, when exactly followed, nothing satisfactory was obtained. C. Miraud, whom I have already had occasion to mention, has found means to make as beautiful paintings on glass as the ancients, by employing muriate of silver, oxide of zinc, white argil, and yellow oxide of iron. These colours are applied on glass merely pounded, and without a flux. The oxide of iron, brings the yellow to that colour, which it ought to have after baking, and contributes with the argil and oxide of zinc, to decompose the muriate of silver, without deoxidating the silver. After the baking, there remains a dust which has not penetrated into the glass, and which is easily removed.

This yellow, when employed thicker, gives darker shades, and produces a russet.

Blues.

It is well known, that these are obtained from the oxide of cobalt. All chemists are acquainted with the preparation of them. Those of Sevres, which are justly esteemed for their beauty, are indebted for it, only to the care employed in manufacturing them, and to the quality of the porcelain, which appears more proper for receiving them, in proportion to the degree of heat it can bear.

The blue of hard porcelain, destined for what is called the ground for a great heat, (*les fonds au grand feu*) is fused with feld-spar; that of soft porcelain has for its flux, silex, potash, and lead: it is not volatilized like the preceding, but the heat it experiences, is very inferior to that of hard porcelain.

These colours, when previously fused, do not change at all in the application.

Blues on glass, exhibit the same phenomena as those on soft porcelain.

Greens.

The greens employed in painting, are made with green oxide of copper, or, sometimes with a mixture of yellow or blue. They must be previously fused with their flux, otherwise they will become black; but after this first fusion they no longer change.

They cannot stand a strong heat, as it would make them disappear entirely. Green grounds for a strong heat are composed with the oxides of cobalt and nickel, but a brownish green only is obtained.

Bluish greens called *celestial blues*, which were formerly colours very much in vogue, can be applied only upon soft porcelain; on hard porcelain they constantly become scaly, because potash enters into their composition.

These greens cannot be applied on glass: they give a dirty colour. To obtain a green on glass, it is necessary to put yellow on one side, and blue, more or less pale, on the other. This colour may be made also, by a mixture of blue, with yellow oxide of iron. I hope to obtain from oxide of chrome a direct green colour. The trials I have made, give me reason to hope for success. Pure chromate of lead, which I applied to porcelain in a strong heat, gave me a pretty beautiful green, of great intensity and very fixed.

Bistres and Russets.

These are obtained by mixtures in different proportions of manganese, brown oxide of copper, and oxide of iron from ombre earth. They are also previously fused with their flux, so that they do not change in any manner on soft porcelain.

This colour fades very speedily on glass.

Russet grounds in a great heat, known under the name of *tortoise shell grounds*, are made in the same manner. Their flux is feldspar.

Blacks.

Blacks are the colours most difficult to be obtained very beautiful. No metallic oxide, gives alone a beautiful black. Manganese is that which approaches nearest to it. Iron gives an opaque, dull, cloudy black, which changes very easily to red: the colour-makers, therefore, to obtain a black which they could not hope for, from the best theorist, have united several metallic oxides, which separately do not give black, and have obtained a very beautiful colour, which, however, is liable to become scaly and dull.

These oxides are those of manganese, the brown oxides of copper, and a little of the oxide of cobalt. The gray is obtained by suppressing the copper, and increasing the dose of the flux.

Having here made known the principles of the fabrication of each principal colour, it may be readily conceived that by mixing these colours together, all the shades possible may be obtained. It is evident, also, that care in the preparation, choice in the raw materials, and a just proportion of doses, must produce in the results, differences very sensible to an eye accustomed to painting. A mere knowledge of the composition of colours, does not give the talent of executing them well.

In recapitulating the facts above mentioned, to present them under another general point of view, it is seen:

1st. That among colours generally employed on hard porcelain, one only, is susceptible of changing, viz. carmine, and the tints into which it enters: that its place may be supplied by the reds of iron, and that no colour then changes.

2nd. That among the colours for soft porcelain and enamel, several change in a considerable degree. These are principally the reds of gold and iron, the yellows, the greens, the browns. They have not been replaced by others, because this kind of painting has been almost abandoned.

3d. That several of the colours on glass change also by acquiring complete transparency. These in particular are the yellows and greens.

4th. That it is neither by calcining the colours in a higher degree, nor previously fusing them, as supposed by some, that they are prevented from changing, since these means really alter the changing colours, and produce no effect on the rest. The change which several colours experience on soft porcelain, and on glass, does not then depend on the nature of their composition, but rather on that of the body on which they are applied.

Consequently, by suppressing from the colours of hard porcelain, the carmine of gold, which is not indispensably necessary, we shall have a series of colours which do not change.

On the valuable Properties of the genuine Emery Stone; and on a superior Process of washing over Emery, invented by Mr. John Isaac Hawkins.

The genuine emery stone is brought to us from *Naxos*, one of the islands in the Greek Archipelago. It is found in hard, compact, stony masses, of a bluish purple colour, interspersed with pyrites. These lumps of emery are used in their native state, in Sweden, to shape porphyry into slabs, mortars, &c.; being held firmly against the masses of porphyry, whilst the latter are turned in large lathes, moved by the power of water. They are also used in this country by the glass cutters, to turn their cast iron laps into shape; and the emery made from them is greatly preferable to any other, in its effects upon the articles to be cut or abraded by it, owing to its great hardness. This valuable property of hardness, however, has increased the difficulty of manufacturing emery from it; and, accordingly, substitutes have been found for it, which fall vastly short, indeed, in this desirable quality. We have even been told, that *the clinkers from a smith's forge* are too often made into what is called emery! We would therefore recommend those persons who wish to obtain emery of a superior description, to make it themselves, of the genuine Greek emery stone, by reducing it to powder in a cast iron mortar with an iron pestle; and then, either sifting it to the required degree of coarseness or fineness, with proper wire sieves; or else, by washing it over in water, as usual, bring it to a state of minuter division, and as described in our article "On Grinding and Polishing Lenses." [See p. 396, Vol. IV.]

On Mr. J. I. Hawkins' Improved mode of Washing Emery.

We have lately been favoured, through the kindness of Mr. Hawkins, with an account of his very superior manner of preparing emery *for nice purposes.* He was induced to effect this, by finding that the emery commonly sold was totally inefficient for the purpose he had in view; namely, grinding two flat surfaces of hard cast-steel accurately; as the workman found that only a few of the coarser parts of the emery scratched the surfaces of the steel plates, and kept the remainder of it from acting at all; and, in fact, that his labour was in vain. On this, Mr. Hawkins thought of applying to emery, a process which he had seen used in Liverpool for washing over *diamond-dust*, to be used in watch jewelling: and, in order to be sure that his emery should be of a good quality, he took the precaution of purchasing, at an eminent emery maker's, a quantity of those small lumps or grains of emery which had longest withstood the action of the cast iron runners and bed; and thus ensured the *hardness* of the emery. These lumps he caused to be reduced to powder in a mortar of cast iron, as we have above mentioned; and then sifted the powder into different varieties, by passing it through a series of wire sieves; the first sieve having 20 squares in the inch, the next 30, and so on to 80: and thus he obtained eight different degrees of emery.

He next treated the emery which had passed through the finest sieve, by washing it over in the same manner as the diamond-dust was treated; namely, in *oil, which held it suspended for a much longer time than the water, which is usually employed for this process:* and in this way he obtained a series of emery, which had floated one minute, five minutes, ten minutes, fifteen minutes, twenty minutes, forty minutes, and eighty minutes; amongst which he found every variety necessary for his purpose, and deposited them in separate boxes for use, numbered according to the minutes they had floated: and he could thus, at any subsequent period, be certain of producing other emeries of the very same description.

We need hardly add, that, by using these latter emeries in succession, beginning with the coarsest, he not only very soon accomplished the object he had in view, but has also since employed them in grinding three flat circular plates of cast iron, to perfectly plane surfaces; correcting, as usual, the tendency in either to become concave or convex, by means of the third plate.

Emery hard enough to cut Rubies.

Mr. Hawkins, pursuing the same practice of selecting those grains of emery which resisted longest the action of the pestle and mortar, eventually obtained some *so hard*, as to be capable of *cutting a ruby*, when employed in a manner similar to *diamond-dust* in watch jewelling.

Sapphires found in the Greek Emery Stone.

The editor has lately treated some portions of the Greek emery stone, by grinding them to powder between two flat and hard steel surfaces, and washing off the lighter parts in oil: he then placed a small portion of what had subsided, after floating only half a minute, upon a slip of glass, and examined it in the microscope, under a highly magnifying power; and found that many parts of it had entirely withstood the grinding action, (except, only, their being separated from the mass,) and were, in fact, *perfectly crystallized sapphires.* [*Technical Repository.*

Illiberal views on the London University, under the title of 'Institutions for the Instruction of the Lower Classes.' From Bell's Weekly Messenger. With remarks by the Editor.

In a late number of 'The Albion,' published in New York, we find, under the above title, the subjoined article, copied from '*Bell's Weekly Messenger.*' The Editor of the Albion says "To its sentiments with regard to the absence of religious instruction we fully subscribe, and it is with a view to giving currency to them, that we are mainly induced to transfer the article to our columns; but we, at the same time, beg to disclaim any participation in the illiberality manifested towards our fellow subjects north of the *Tweed.*"

'*We*, are mainly induced to transfer the article to our pages,' for the purpose of affording, by contrast, one proof, among thousands which might be selected, of the eminently favourable influence of free institutions which are purely civil, over those which are connected with national ecclesiastical establishments, in promoting the universal diffusion of knowledge.

Our readers, generally, are aware that a number of influential, liberal, and enlightened individuals, have associated, and munificently contributed, for the purpose of establishing a University in the city of London, not for the instruction of the *lower* classes, but in order to extend the benefits of a liberal education to the sons of those citizens, whose circumstances, or whose religious opinions, prevent their admission into the national Universities. In the ardour with which this plan has been promoted by men high in official station, many of whom are warmly attached to the church, as a religious institution, we witness the triumph of the spirit of the times, over that domineering hierarchy, which in other periods has taught, that 'ignorance is the mother of devotion;' whilst in the tone of malignant asperity which pervades the observations before us, there is manifested a complete absence of the benign influence of christianity, and a fear evinced, that the faith of those may be shaken, who have been taught to believe, that the image of the goddess Diana, actually fell down from heaven.

We are not about to enter upon any religious, or political controversy; this is quite as foreign to our inclination, as it is to the objects of this Journal; but whilst public institutions for scientific and moral instruction, are, as they ever must be, greatly influenced by the religious and political establishments of a country, we should deem ourselves reprehensibly fastidious, were we to avoid a passing notice of their connexion, when speaking of the diffusion of knowledge.

We are so far from apprehending that observations written in a tone of such malignant asperity will aid the cause which they profess to espouse, that supposing them to have been foisted upon the London editor, by some friend of the University who wished to exhibit a picture of its enemies in strong caricature, we should think that the effort must have been very successful; the editorial form given to the article, seems, however, to forbid the serious formation of such a conjecture.

"We have always been a friend to the Mechanic Institutions which are now so common in the kingdom, and we are much disposed to applaud those publications which are now weekly issued for the instruction of the lower orders, in philosophy, science, and the mechanic arts. There is, perhaps, a good deal of pretension in these books, and in the plan itself, and they will not altogether, we apprehend, answer their purpose. These weekly lectures are very abstruse; they are written with little elegance, or illumination of style, and present science, (which, in its elements, is always difficult and without attraction,) in a very uncouth dress. But the attempt is certainly praiseworthy, and we trust it will answer the purpose of the booksellers.

"We cannot, however, extend the like good wishes to the London University; for, though no one can wish better to the interest of the great majority of the inhabitants of London than ourselves—and though we have, as we may truly say, a direct interest in their education, and in the active curiosity and habits of reading to which such an education leads, we must be allowed to express our most decided opinion against the necessity and utility of this Metropolitan College, —which is now, we think, at a stand, or, at least, somewhat in the wane. As a means of diffusing science, it is a piece of quackery. As a corporate body, or even as a large assemblage of men, united together in a pursuit and profession, above all others, pregnant with self-conceit and presumptuous arrogance, it will be full of danger to the established institutions of the country.

"In the first place, the very character and professed objects of such a University, its mode of institution, and the fundamental principle upon which it professes to open and to proceed, is contrary to the very nature of a University, or Collegiate Institution. What, in fact, is a suitable notion of a University?

"A University is a civil institution for the purposes of educating the members of a state for the learned professions, and for the lay and ecclesiastical orders of the community, and patronized and protected by the state, because the principles of education are conformable with the government and constitution of the country; and because such education assists the due progress of government and its daily administration. A University, therefore, is a civil institution of the state, recognising its establishments, and directing its course of education towards maintaining and upholding the government and its orders. Upon what principle, therefore, can the state be called to patronize, or even allow, a confederacy of teachers and lecturers, who profess to have no reference to, or connexion with, the establishments of the country, but systematically put out of their view the first and principal of our civil and religious institutions? What right has such a confederacy to the application of the public and civil appellation of a University; that is to say, to be considered as a part of the state, and a member of the orders of the realm? We have lived, however, too long to found arguments upon mere words, and upon a mere inconsistency between the thing and its appellation. Our main assertion is this,—that such an institution cannot be friendly either to the church—to the ancient and established Universities—nor to the state itself. And a very few words will, we think, make this appear.

"As regards the church, the principles of this Scottish confederacy,—this Lancaster college,—this Birkbeck University, are, that the system of education shall be wholly and systematically indifferent to all religious instruction altogether; that the name of religion shall never be mentioned, and that Jew, Turk, Infidel, and Scotch lecturers, shall be equally welcome, and enjoy a perfect equality. Now, let us ask any one acquainted with the human heart, and with the certain course of human habits and feelings, what will necessarily be the state of mind, of feelings, of habits, as to religion, of the youth so educated, so systematically taught to regard all religion as a matter of perfect indifference?

"In what we daily and hourly see amongst ourselves, in our own warehouses and workshops, in this great metropolis, what kind of youths do we find those to be, who have been brought up in a total neglect of all religious duties—of Sabbath worship, and of any prayer, either public or private? Do we, in a word, ever find any one religious, or giving religion a thought, unless they have been educated in it, and to it, from childhood? Does not the daily experience of life show, that God, in the distribution of his blessings, always acts by aiding, assisting, and co-operating with second means, and that religious instruction by parents is the secondary means, which his wisdom has appointed, to continue religion to our children?

"In short, we feel it unnecessary to argue with any length now upon this subject, or to say more than to recall to memory the positive command in our Scriptures to *teach* children the fear of God,—to bring them up in the nurture and admonition of piety.

"But according to this University system, this Scotch education manufactory, every one is to be left to himself. 'No,' you say, 'to their parents.' But when parents send their children to school or to the University, such school or University becomes their instructors, and the parents deem it unnecessary to occupy themselves any longer in their instruction. Let us not be deceived by words,—let us remember only what daily passes in our own houses and families; and let us think, and think seriously, what will be the state of our children under such instructors. Not only the disuse and mere absence of all religious subjects, but a systematic indifference and contempt towards it, legibly written in the very principles of the system.

"As to the spirit with which this Owen University, this Lanark College, with its Scotch chancellor, and vice-chancellor, will regard the ancient Universities of the realm, is it a matter of doubt for a moment, how a drove of prating and conceited professors, lecturing on the principles and practice of carpentry, the friction of wheels, and the laws of the universe, will regard the quiet and noiseless science of their competitors at Cambridge? which every year (every single year, without exception) produces, not one or two, but a long list of men, and those very young men, not exceeding two or three and twenty years of age, in comparison with whom their highest professor would be but a school-boy. Has Glasgow or Edinburgh one man, even one, who could stand a comparison with the first wrangler of any year at Cambridge? And does Mr. Brougham himself know what mathematics and science are, when he talks so fluently of rendering labouring mechanics mathematicians, by his London University? He might as well, indeed, with much more hope of success, make a London University for lawyers.

"In a word, we wish well to every thing which can add to human virtue and happiness. But this lay, London, University will administer to neither of these great ends. It will bring the conceit of the modern Athens into the midst of us, and will teach so many to talk and dispute, that we shall have none to work. We shall have as many lecturers as labourers, and the tutors and professors will be as troublesome in our families, as were the Jesuits in old times. The mischief will begin with our sons, and perhaps, as the lectures are to be public, will extend to our wives. A plain man will have a Scotch reason assigned to him against every thing he proposes; there will be an end of all peace and quietness, and what is worse, of all admitted principles in truth and morals. Mr. Brougham and Mr. T. Campbell are very eloquent, and doubtless very learned men, but we shall repent it, if we bring them into the common council, and ask their advice how we shall educate our sons and apprentices."

Notice of an attempt to Navigate the air by means of Kites.

[From a London paper.]

We noticed a short time since in the scientific department of our Magazine, the project of a gentleman of the name of Pocock, a schoolmaster of Bristol, for propelling a species of wheel carriage by means of the power of *kites*. An experiment made with this *char-volant*, some months back, near Windsor, in which it overtook and outstripped the carriage of the Duke of Gloucester, (his highness chancing to pass the same way,) was noticed at the time, by several London and provincial papers; and Mr. Pocock has now published a quarto book in explanation of his invention, interspersed with plates—some exhibiting men flying in the air at the tails of kites—others, ships at sea, and stranded, sending messengers to shore by them—others, carriages drawn over hill and dale by them—which horsemen riding *ventre a terre*, as the French describe it, are unable to overtake; altogether, a work as wild and eccentric as some persons will consider the discovery itself.

The objects—that is to say, the more important objects—to which Mr. Pocock finds his invention particularly applicable, are three in number: the propelling of ships in calm weather at sea; the drawing of carriages by land; and the elevating of individuals to enormous heights in the air, for the purposes of observation, escalade of fortresses, crossing of rivers, or any other acts for which such an exalted location may be considered available. All these works, he assures the public, have been *experimentally accomplished* by the kites; and although the author himself admits that some of his accounts have been thought a little strange by people not habitually incredulous, yet there is considerable curiosity in the steps by which his invention has been brought to its present state, as well as approved truth in many of the results which he describes to have been obtained from it.

Mr. Pocock informs us, that having, when a boy, conceived some notions of the probability of making the drawing power of a kite applicable to useful purposes in life, it became an object with him, of course, in the first place, to try to what extent the force of the engine in question could be carried. With this view, he conceived the idea of procuring *two* paper kites; and flying up the *first* until *it would carry no more string*, he then tied the end of the first kite string, to the back of the second kite; and letting *that* up with its own length of cordage, he soon discovered that by adding *kite after kite* in this manner, an almost indefinite extent of power and elevation might be obtained. Encouraged by having fixed this principle, he proceeded in his labours; making a variety of improvements almost immediately, in the construction and management of his kites; such as building them *jointed*, in order that when of a large size they should be more portable; covering them with *linen* instead of paper, that they might be proof against the weather; and, particularly, furnishing them with three cords, (independent of the main, or drawing string,) called *brace lines*, the effect of which was to regulate their power when elevated, and to direct their course, without being left entirely at the discretion of the wind, through the atmosphere; until, at length, having further constructed a carriage peculiarly adapted to the application of his new impulse, he arrived so far at success, as to be able upon ordinary roads to perform journeys at the rate of twenty miles an hour; and to outstrip, as has already been stated, on one occasion, the carriage of the duke of Gloucester, with his royal highness's postilions, (as he says,) putting their horses to the gallop.

For a full account of many strange matters that occurred in the course of the inventor's experiments, our readers must consult the book itself: but the practicability of impelling a carriage along a common road by the aid of kites, certainly seems established beyond all doubt. On one trial, (on the 8th January in the present year,) the projector performed a mile of ground over a very heavy road, in *two minutes and three-quarters;* and on the same day, several other miles in *three minutes* each. This was done between Bristol and Marlborough. At another time, he says he beat a London stage coach, in a distance of *ten miles*, by no less than *twenty-five* minutes. Moreover, as although by the assistance of the *brace lines*, his kites work perfectly well with a *side* wind, it is impossible for them to work *against* the wind, and consequently not easy for a traveller to go a journey with them, and come back, (the wind remaining in the same quarter,) in the same day—to obviate every difficulty, the inventor has added *a platform to the back of his kite-carriage*, upon which *a pair of horses are carried along with the traveller!* remaining at all times fresh and in order, ready to be harnessed and set to work, in case the wind should fall, or veer round, or any other accident should make the ministry of such animals necessary!—These are the sort of speculations that every now and then make Mr. Pocock's narrative a little staggering.

The power of a kite twelve feet high, with a wind blowing at the rate of twenty miles an hour, is as much, our author says, as a man of moderate strength can stand against. Larger kites, of course, would have their power in proportion.

Beyond drawing carriages, [by the way, how admirably these engines would do to tow canal boats?] Mr. Pocock, as we have already observed, looks that his kites shall be useful in propelling ships in calm weather. This expectation is founded upon the following fact:—Experiments have shown, he says, that when a dead calm exists upon the level or surface of the sea—at the height of 150 feet in the air, a current of wind is often running at the rate of sixteen miles an hour. By elevating his kite in due time, the voyager would have the advantage of this breeze, while those ships unprovided therewith, would lie like logs upon the water, with their sails flapping.

In cases of shipwreck upon a lee-shore, nothing of course would be more easy than to send a rope or a grappling iron to the top of a cliff by the same sort of conveyance: but should it be deemed more expedient at once to send *a person* on shore, he may be borne, the author says, "above the bursting billows, and alight, like a messenger of good from the flood," upon the cliff or beach, as the case may be! In fact, he adds, if it so happened that female passengers or children were in the vessel so situated—"what mode could be so desirable as to swing them securely in a hammock or cot, and thus transport them above the foaming billows, and land them dry shod on the shore?" And again, "these kites having power to elevate one in the air," might be of the highest use in military service: as from such "flying observations, all the movements and manœuvres of an army might be distinctly marked."

As *this* particular portion of Mr. Pocock's plan is the most curious and surprising, we regret that he has not been more careful in communicating the details of his experiments with respect to it. He pledges himself in distinct terms, that the thing—that that sort of elevation—*has been done;* and that "his daughter, who earnestly claimed from him the daring honour, was the first aeropleust." Still this is all the account we have of what has been effected in the way of *actual ascension into the air*, while the notices of experiments upon *terra firma* are given with the greatest possible amplitude and particularity.

For the present, however—certainly regretting the absence of information upon this material point, and also that his work generally is written in a style which makes it difficult to distinguish, sometimes, whether he is in jest or earnest—we must leave Mr. Pocock and his invention; not at all prejudicing our right to return to the discussion of his operations, hereafter. As the thing stands, what has been done is very amusing, and displays great ingenuity; but we rather doubt the possibility of applying the power to any purposes beyond those of diversion. When the public, however, shall be possessed of more ample details as to the *extent* and *result* of Miss Pocock's or any body else's "*aeropleustic*" *elevation*, we shall then be better qualified to offer an opinion upon the probable eventual success of the author's project.—[*London Paper.*

Remarks by the Editor.—We insert the foregoing, principally, for the purpose of amusing our readers, at the expense of the great projector of this new mode of flying; we are aware, however, that it may also answer the useful purpose of comforting some of our own fellow citizens, whose grand schemes for 'surmounting insurmountable obstacles,' are occasionally obscured, if not eclipsed, by discoveries made on the eastern shores of the atlantic. By a reference to the Biography of Alexander Wilson, in our third volume, it will be seen that Mr. Pocock's plan of attaching one kite to another, has not itself the claims of novelty, although the object which he proposes to accomplish, namely, that of ascending in the air, at the end of the tail, is altogether so; when he accomplishes this, aided, perhaps, by a high wind, and a magnificent kite, made from the mainsails of a few of his majesty's first rates, he may hang his hat upon one of the horns of the moon.

On the Use of Perfumes in preventing the formation of Mouldiness.

By John MacCulloch, M. D.

There are many cases of daily occurrence, in which the growth of those minute vegetables that constitute mouldiness, is a very troublesome inconvenience. As your Journal does not despise the useful, I need make no apology for a communication that has no other quality to recommend it.

I do not pretend to account for the mode in which perfumes act in producing this effect; nor do I know the limitations with respect to these: but I have found it hold good with all the essential oils that I have tried, and that even when used in a very minute quantity.

Ink, paste, leather, and seeds, are among the common articles which suffer from this cause, and to which the remedy is easily applicable. With respect to articles of food, such as bread, cold meats, or dried fish, it is less easy to apply a remedy, on account of the taste. Cloves, however, and other spices whose flavours are grateful, may sometimes be used for this end; and that they act in consequence of this principle, and not by any particular antiseptic virtue, seems plain, by their preventing equally the growth of minute cryptogamous plants on ink, and other substances not of animal nature.

The effect of cloves in preventing the mouldiness of ink, is indeed generally known; and it is obtained in the same way by oil of lavender, in a very minute quantity, or by any other of the perfumed oils.

To preserve leather in the same manner from this effect, is a matter of great importance, particularly in military storehouses, where the labour employed in cleaning harness, and shoes, is a cause of considerable expense; and where much injury is occasionally sustained from this cause. The same essential oils answer the purpose, as far as I have had an opportunity of trying, effectually. The cheapest, of course, should be selected; and it would be necessary to try oil of turpentine, for this reason. The total interruption of all my pursuits has hitherto prevented me from carrying these trials as far as I intended.

It is a remarkable confirmation of this circumstance, that Russia leather, which is perfumed with the tar of the birch-tree, is not subject to mouldiness, as must be well known to all who possess books, thus bound. They even prevent it from taking place in those books bound in calf, near to which they happen to lie. This fact is particularly well known to Russia merchants, as they suffer bales of this article to lie in the London docks in the most careless manner, for a great length of time; knowing well that they can sustain no injury of this nature from dampness, whereas, common curried leather requires to be opened, cleaned and ventilated. Collectors of books will not be sorry to learn, that a few drops of any perfumed oil will ensure their libraries from this pest.

I had commenced some trials on wood, on the same principle, with the view of preserving it from what is called the dry-rot; and, as it seemed to me, with effect. But as I have now no hopes of pursuing this subject, I am glad to have an opportunity, by your means, of putting it into better hands. A cheap oil, of course, would be required for operations so extensive as this.

The next substance that I shall point out, is paste, which is a very perishable article. Alum, which is used by the book-binders, although it preserves that most necessary substance longer than it would remain useful without it, is not very effectual. Rosin, sometimes used by shoemakers, answers the purpose better, and appears to act entirely on this principle. It is, however, less effectual than even oil of turpentine. Lavender, and the other strong perfumes, such as peppermint, anise, and bergamot, are perfectly effectual, even in a very small quantity; and paste may thus be preserved for any length of time.

Your mineralogical readers in particular, who have frequent occasion to use paste for their labels in very small quantities, and where the trouble of thus making it on every fresh occasion is inconvenient, will be glad to know that this useful article may be made to keep, even for years, always ready for use, and subject to no change.

That which I have long used in this manner, is made of flour in the usual way, but rather thick, with a proportion of brown sugar, and a small quantity of corrosive sublimate. The use of the sugar is to keep it flexible, so as to prevent its scaling off from smooth surfaces; and that of the corrosive sublimate, independently of preserving it from insects, is an effectual check against its fermentation. This salt, however, does not prevent the formation of mouldiness. But as a drop or two of the essential oils above mentioned is a complete security against this, all the causes of destruction are effectually guarded against. Paste made in this manner, and exposed to the air, dries without change to a state resembling horn; so that it may at any time be wetted again, and applied to use. When kept in a close covered pot, it may be preserved in a state fit for use at all times.

This principle seems also applicable to the preservation of seeds, particularly in cases where they are sent from distant countries by sea, when it is well known that they often perish from this cause. Dampness, of course, will perform its office at any rate, if moisture is not excluded; yet it is certain that the growth of the vegetables which constitute mould, accelerate the evil; whether by retaining moisture, or by what means, is not very apparent. This, in fact, happens equally in the case of dry-rot in wood; and, indeed, in all others where this cause operates. It is a curious illustration of the truth of this view of a remedy, that the aromatic seeds of all kinds are not subject to mould, and that their vicinity prevents it in others with which they are packed. They also produce the same effect daily, even in animal matters, without its being suspected. Not to repeat any thing on the subject of cookery, I need only remark, that it is common to put pepper into collections of insects, or birds, without its having been remarked that it had the same power of keeping off mould, as of discouraging or killing the *Ptinus omnivorus*, or other insects that commit ravages in these cases.

In concluding these hints, I might add, in illustration of them, that gingerbread, and bread containing carraway-seeds, is far less liable to mouldiness than plain bread. It will be a matter worthy of consideration, how far flour might be preserved by some project of this kind. [*Ed. Phil. Journal.*

On a beautiful Blue Colour. *By* M. BRACONNOT.

A PORTION of a very fine blue pigment was placed in the hands of M. Braconnot, by M. Noel, for examination. It was the produce of a manufacture at Schweinfurt, where the preparation was kept secret. M. Braconnot readily ascertained it to be a triple compound of arsenious acid, hydrated deutoxide of copper, and acetic acid; so that it approximates to the green of Scheele. After various trials to form it, the following process was found to be the best. Six parts of sulphate of copper were dissolved in a small quantity of water; also, six parts of white arsenic, with eight parts of potash of commerce, were boiled in water, until no further quantity of carbonic acid was disengaged. This hot solution was gradually mixed with the first, continually agitating until effervescence ceased; an abundant dull yellowish green precipitate was formed. About three parts of acetic acid were then added, or such a quantity, that a slight excess was sensible to the smell; gradually the precipitate diminished in volume, and in some hours, a slightly crystalline powder was deposited at the bottom of an entirely colourless solution. The fluid was poured off as soon as possible; and the powder, washed with plenty of boiling water to remove the last portions of arsenic, was then of a brilliant colour.

Care must be taken not to add to the cupreous solution an excess of arseniate of potash, as it causes waste of the acetic acid afterwards added, as the latter must be in excess. In repeating the process in the large way, an arseniate of potash, prepared with eight parts of oxide of arsenic, instead of six, was used, and the result was very successful. M. Braconnot thinks that probably a slight variation of the proportions he has given may be found advantageous; but in the mean time considers it right to give the best process he is able for the preparation of a colour so beautiful, and which may be very valuable in the arts. [*Ann. de Chim.*

Account of Mr. Barton's *Method of making the Iris Metal Ornaments, or of Ornamenting Steel and other Metals, with the Prismatic Colours.*

Mr. Barton, of the Mint, a gentleman well known for his ingenuity and his mechanical attainments, has recently conceived the happy idea of ornamenting steel, and other articles, with the colours of striated surfaces, and has secured, by patent, the exclusive privilege of applying this principle to practical purposes. The excellence of Mr. Barton's engine has, no doubt, enabled him to execute this kind of work, with a beauty and precision which no other person can hope to imitate. The engine which he uses was given to him by his father-in-law, the late celebrated Mr. Harrison. It was constructed by Mr. Harrison himself, and its merits depend chiefly on the beauty and correctness of the screw; the apparatus for cutting which, by an excellent inclined plane, also accompanied the engine. The plate on the screw is not divided higher than the 2000dth part of an inch; but Mr. Barton has drawn divisions on steel and glass so minute as the 10,000dth part of an inch. In drawing lines of 2000 in an inch, Mr. Barton often leaves out *one line* intentionally; and one of the greatest proofs of the stability of his engine is, that after having taken off the brass table, with the work upon it, (when the omission is distinctly perceived,) *he can restore it to its place, and introduce the line, without its being distinguishable from the rest.*

In applying the principle of striated colours to ornament steel, the effect or pattern is produced upon the polished surface, by the point of a diamond; so that either the whole, or a part of the surface, is covered with lines or grooves, whose distance may vary from the 1000dth to the 10,000dth of an inch. When these lines are *most distant*, the prismatic images of the candle, or any luminous body, seen by reflection from the polished surface, are *nearest* one another, and the common colourless image; and when the lines are *least dis-*

tant, the coloured images are *farthest* from one another, and the colours are most vivid.

In daylight, the colours produced by these minute grooves are scarcely distinguishable, unless at the boundary between a dark and a luminous object: and we conceive that their brilliancy will be very much impaired, even with artificial lights, when they are dispersed by the interposition of globes, or hemispheres of ground glass.

In sharp lights, however, and particularly in that of the sun, the colours shine with extraordinary brilliancy, and the play of tints which accompany every luminous image, can only be equalled by their matchless exhibition in the reflections of the diamond. The surface of fine steel, therefore, when grooved by such a skilful hand as Mr. Barton's, is peculiarly fitted for imitative jewels, and other articles of female dress: and we have no doubt that it will find an application to many other purposes, both of use and ornament.

The divisions which Mr. Barton most commonly uses for his metal ornaments are 2000 to an inch; but when the material is good, his engine enables him to divide to 5000 and 10,000. When the lines, however, are so close, the labour is very great; but the beauty of the work is generally a compensation for the time bestowed upon it, as the strength of the colours increases with the number of lines. The depth of the line, Mr. Barton finds to have a great effect in producing brilliancy, owing to the increase in the quantity of reflected light; and he is, in some measure, enabled to judge of the depth, by the faintness of the reflected image of his eye, when looking perpendicularly at the steel, until at last, by totally removing the original surface, in consequence of the edges of the cut meeting, the whole surface looks black, and the eye is no longer seen.

Since the preceding notice was written, Mr. Barton has had the kindness to favour us with various specimens of the ornaments executed by his engine; and high as our expectations were, we confess they were greatly surpassed by the work itself.

Some of the specimens are struck from steel dies, containing the grooved pattern, and it is singular to observe the perfection with which the impress of such delicate work has been conveyed.

[*Ed. Phil. Journal.*

On the ancient Grecian method of Painting in Encaustic. By Miss E. J. Greenland.

[From the Transactions of the Society for the Encouragement of Arts, &c. &c.]

The well known disadvantages that paintings in oil lie under, have rendered the discovery of some other vehicle, an object of attentive inquiry among the learned; and dissertations have been written on the subject by various authors, as Count Caylus, Muntz, &c.

Wax has been universally considered as the most likely substance to supply the place of the oil; and most of the writers have recommended the uniting it with alkaline salts, into a kind of soap, for that purpose: the impropriety of such a measure is evident to any one in the least acquainted with the properties of those salts.

The brilliancy of the colours in the picture painted by Miss Greenland, fully justifies the opinion that the method made use of by her, provides against all those inconveniences.

Miss G. says, "I was extremely fortunate when at Florence, the summer before last, in the acquaintance of an *amateur* of painting, who procured me the satisfaction of seeing some paintings in the ancient Grecian style, executed by Signora Parenti, a professor at that place, who received her instructions from a Jesuit, at Pavia, the person who made the farthest discoveries in that art. My friend, knowing I was fond of painting, very politely informed me what were the materials the paintress used; but could not tell me the proportions of the compositions: however, from my anxiety to succeed in such an acquisition, I made various experiments; and, at last, obtained such a sufficient knowledge of the quantities of the different ingredients as to begin and finish a picture, which I shall be happy to lay before the society for their inspection."

The ancient Grecian method of Painting.

Take an ounce of white wax, and the same weight of gum-mastich, in tears, that is, as it comes from the tree, which must be reduced to a coarse powder. Put the wax in a glazed earthen vessel, over a very slow fire, and when it is quite dissolved, strew in the mastich, a little at a time, stirring the wax continually, until the whole quantity of gum is perfectly melted and incorporated; then throw the paste into cold water, and when it is hard, take it out of the water, wipe it dry, and beat it in a Wedgewood's mortar; observing to pound it at first in a linen cloth, to absorb some drops of water that will remain in the paste, and would prevent the possibility of reducing it to a powder, which must be so fine as to pass through a thick gauze. It should be pounded in a cold place, and but a little while at a time; as, after long beating, the friction will, in a degree, soften the wax and gum; and, instead of their becoming a powder, they will return to a paste.

Make some strong gum-arabic water, and when you paint, take a little of the powder, some colour, and mix them together with gum-water. Light colours require but a small quantity of the powder; but more of it must be put in proportion to the body and darkness of the colours; and, to black, there should be almost as much of the powder as of the colour.

Having mixed the colours, and no more than can be used before they grow dry; paint with fair water, as is practised in painting with water-colours; a ground on the wood, being first painted, of some proper colour, prepared in the same manner as is described for the picture:—walnut tree and oak, are the sorts of wood commonly made use of in Italy for this purpose. The painting should be very highly finished, otherwise, when varnished, the tints will not appear united.

When the painting is quite dry, with rather a hard brush, passing it one way, varnish it with white wax, which is put into an earthen vessel, and kept melted over a very slow fire, till the picture is varnished; taking great care that the wax does not boil. Afterwards, hold the picture before a fire, near enough to melt the wax, but not to make it run; and when the varnish is entirely cold and hard, rub it gently with a linen cloth. Should the varnish blister, warm the picture again slowly, and the bubbles will subside.

When the picture is dirty, it need only be washed with cold water.

After the experience of some years had suggested some improvements, Miss G. made the following communication.

Method of uniting wax and mastich with water, in making a composition for Painting, in imitation of the ancient Grecian manner.

Put into a glazed earthen vessel, four ounces and a half of gum-arabic, and eight ounces of cold spring water: when the gum is dissolved, stir in seven ounces of gum-mastich, which has been first washed, dried, and beaten fine—which is very soon done: set the earthen vessel, containing the gum-water and gum-mastich, over a moderate fire, continually stirring and beating them hard with a spoon, in order to dissolve the gum-mastich. When sufficiently boiled, it will no longer appear transparent, and will be stiff like a paste. So soon as this is the case, and that the gum-water and mastich are quite boiling, without taking them off the fire, add five ounces of white wax, broken into small pieces, stirring and beating the different ingredients together, till the wax is perfectly melted, and has boiled: then take the composition off the fire; as boiling it longer than necessary, would only harden the wax, and prevent its mixing so well afterwards with water. When the composition is taken off the fire, and in the glazed earthen vessel, it should be beaten hard; and, whilst hot, but not boiling, mix with it, by degrees, sixteen ounces of cold spring water; then strain the composition, as some dirt will boil out of the gum-mastich, and put it into bottles.

The composition, if properly made, should be like cream, and the colours, when mixed with it, as smooth as if with oil. The method of using it, is, mixing the colours with it as with oil; then paint with fair water. The colours, if grown dry, when mixed with the composition, may be used by putting a little fair water over them; but it is less trouble to put some water, when the colours are observed to be growing dry.

In painting with this composition, the colours blend without difficulty, when wet; and even when dry, the tints may be easily united by means of a brush, and a very small quantity of fair water.

When the painting is finished, put some white wax into a glazed earthen vessel, over a slow fire; and, when melted, but not boiling, with a hard brush cover the painting with the wax; and when cold, take a moderately hot iron, such as is used for ironing linen, and draw it lightly over the wax. When the picture is nearly cold, rub it with a fine linen cloth to make it entirely smooth; and when quite cold, rub it again to make it shine.

Paintings might be executed in this manner upon wood, or plaster of Paris, without requiring any other preparation than mixing some fine plaster of Paris, in powder, with cold water, to the thickness of cream; then pour it on a looking-glass; and when dry, take it off; and there will be thus formed, a very smooth surface for painting upon.

Paintings may also be done in the same manner, with gum-water and gum-mastich only, prepared the same way as the mastich and wax; but, instead of putting seven ounces of mastich, and when boiling, adding five ounces of wax; mix twelve ounces of gum-mastich with the gum-water, before it is put on the fire, and when sufficiently boiled and beaten, and it is a little cold, stir in twelve ounces of cold spring water, and afterwards strain it.

It would be equally practicable to paint with wax alone, dissolved in gum-water, in the following manner.

Weigh twelve ounces of cold spring water, and four ounces and a half of gum-arabic: put them into a glazed earthen vessel, and when the gum is dissolved, add eight ounces of white wax. Put the earthen vessel, with the gum-water and wax, upon a slow fire, and stir them till the wax is dissolved, and has boiled a few minutes; then take them off the fire, and throw them into a basin; as, by remaining in the hot earthen vessel, the wax might become rather hard: beat the gum-water and wax, till quite cold. As there is but a small portion of water, in comparison to the quantities of gum and wax, it would be necessary in mixing the composition with the colours, to put also some fair water.

It should be observed, that the water used by Miss Greenland in these preparations, came from a chalk rock, and was remarkably soft: possibly, any other water might answer equally well.

Origin and History of Glass.

The word glass is supposed to be derived from the German *glessum*, the name for amber, which it was thought to resemble in its transparency and brightness. Some imagine glass to have been invented before the flood, and that Moses alluded to the sands that glass was made of, when he said to Zebulon—"They shall suck of the abundance of the seas, and of treasures hid in the sand;" for in the inheritance of that tribe, or very near the frontier of it, ran the little river Belus, where a particular kind of sand was to be found, of great use in the manufacture of glass; which Pliny corroborates by informing us, that glass was first accidentally discovered in Syria, at the mouth of the river Belus, by certain merchants driven thither by the fortune of the sea, who being obliged to live there and dress their victuals by making a fire on the ground, collected some of the plant kali, of which there was an abundance on the spot, for that purpose: this herb being burnt to ashes, occasioned a vitrification of the sand and stones that adhered to it, thus producing glass, and affording a hint for the fabrication of it.

The period when this discovery was made, is involved in considerable obscurity; for it seems to be the general opinion, that what has been denominated glass in the Old Testament, as well as in some of the translations from ancient Greek authors, ought rather to have been termed crystal: however, our knowledge of this invention is principally derived from the Romans; though Theophrastus, who lived about 300 B. C., has given us some account of glass, which he also describes as being made of the sand of the river Belus.

The first glass-houses were erected at Sidon, near the mouth of the Belus; but the glass-houses of Alexandria, were most celebrated among the ancients, for the skill and ingenuity of the workmen employed in them; and from these the Romans for a long time procured all their glass-ware.

Lucretius, who wrote about 60 B. C., is the earliest among the Latins who makes any mention of glass, which appears to have been brought into use at Rome in the time of Augustus: and, if the following anecdote be true, the manufacture of it, under his successor, was carried to a far greater degree of perfection than the moderns are capable of.

It is related that, in the time of Tiberius, an artificer in Rome, made a glass vessel of so tenacious a temper, that it was as difficult to break as if it had been made of metal; and which being thrown with great violence on the ground, in the presence of the emperor, was not broken, but bruised, and was immediately beaten into its former shape, by an instrument which the artificer had ready for that purpose. The emperor, who appeared to have been rather more alarmed than pleased with the experiment, inquired of the inventor if any other person besides himself, was privy to this method of tempering glass, and rendering it malleable, and being answered in the negative, he ordered the unfortunate artificer to be put to death, saying, that if the art should become generally known, gold and silver would be of as little value as dirt.

Pliny observes, that in his time, glass was made with the sand found at the mouth of the river Vulturnus, between Cumæ and the Lucrine Bay. This sand was very fine, and, being mixed with three parts of the fossil alkali, and fused, was conveyed in a liquid state into other furnaces, where it was formed into a mass called ammonitrum, which being again melted, became pure glass, and was brought to the shape required by blowing with the breath, though some pieces were ground on a lathe, and others embossed in the same manner as gold and silver; he further notices, that no substance was more manageable in receiving colours, or being formed into shape. than glass. And it appears from Martial, that glass was not only in common use for drinking vessels, but was likewise formed into bottles, in which wine was kept: and a regular company of glass manufacturers, was soon afterwards established, near the Porta Capena, at Rome; but the Romans, in general, preferred silver and gold, to glass, for the composition of their drinking vessels.

Some square panes of a *glazed window* were discovered at Herculaneum, which proves that the Romans made use of glass, as well as of the lapis specularis and phengitas, noticed by Seneca, for the admission of light into their rooms.

It is presumed, that the *manganese* was made use of to purify glass in the time of Pliny, as he more than once remarks, that the magnet was employed in glass; and under this name the ancients comprehended manganese, though the term itself, was first used by Albertus Magnus.

The art of manufacturing glass into such ornaments as beads and amulets, was known to the ancient Britons, long before the arrival of the Romans: they also, according to Strabo, made vessels of glass which were generally of a blue-green cast; but, as no notice is taken of this manufacture during the period of the Roman government, it was, probably, one of those arts which, being only known to the Druids, was lost on the extermination of that people by Suetonius Paulinus.

The venerable Bede informs us, that the Abbot Benedict, about the year 674, first brought from Italy artificers skilled in making of glass, for the purpose of glazing the church and monastery at Weremouth; and as St. Jerome, who wrote early in the fifth century, and Gregory of Tours, in the sixth century, make mention of windows formed of glass melted, and cast into thin plates, being used in their time, it would seem that this was one of the few arts, which, from its great utility, was able to withstand the shock of Gothic devastation; yet glass windows were but rarely used on the continent, even in the twelfth century. Among Madox's collections of the 49th Henry III., is an abstract of a roll marked Woodstock, evincing that so long ago as 1265, glass windows were used in his palace, at that place, as also at Westminster; and that Chaucer's chamber windows were glazed, we gather from his *Dreame:*—

> "My windows wherein shet echone.
> And through the glasse the sunne yshone,
> Upon my bed with bright bemis,
> With many glad gildy stremis." *l.* 333.

In a charter of Richard II., 1386, mention is made of glass, together with the manufacture of it for windows. The glass for Warwick Chapel, in the time of Henry VI., was procured from abroad, at two shillings a foot; and it seems to be the general opinion, that most of the windows in this country, were made of lattice, and not of glass, till the commencement of the sixteenth century. William Harrison, who wrote in 1577, observes, "that of old time, our countrie houses instead of glasse did use much lattice, and that made either of wicker, or fine rifts of oke in checker-wise; I read also that some of the better sort, in and before the times of the Saxons, did make panels of horne instead of glasse, and fix them in wood calmes, but as horne in windows is *now* quite laid down in every place, so our lattices are also growne into lesse use, because glasse is nearly as cheape, if not better, than the other." But glass windows were not introduced into the better sort of farm-houses in the country, till the commencement of the seventeenth century.

The Venetians, about the commencement of the fourteenth century, became celebrated for their glass manufactories at Mureno; and from that time till the middle of the seventeenth century, they generally supplied the rest of Europe with this article. Our ancestors generally drank out of cups made either of wood, horn, or metal: cups of crystal glass were imported from Venice during the reign of James I., and were placed in recesses, as objects of value and curiosity, along with the china and plate, in the time of Charles II. A manufacture of glass was first established in London, in 1557, and was considerably improved in 1635, by the adoption of pit, or sea coal, instead of wood. Soon afterwards a monopoly was granted to Sir Robert Mansell, to import the fine Venetian flint glasses for drinking; the art of making which, was not brought to perfection before the reign of William III. In 1670, the Duke of Buckingham, having procured some artists from Venice, introduced the manufacture of fine glass into England, with so much success, as, in the course of a century, to have surpassed the productions of the Venetians themselves.

The art of *casting* glass in plates, was invented by Abraham Thevant, a Frenchman, in 1688, and first practised in this country, at Prescott, in Lancashire, in 1773.

The art of tinging the glass with various *colours* was known to the ancients, and practised at Alexandria; for we read that cups manufactured at that place, were presented to the emperor Adrian, which sparkled with colours of every kind, and Strabo says this was effected by a peculiar earth which was only to be met with in Egypt. In some collections of antiquities at Rome, are pieces of glass so perfectly coloured and transparent throughout, that they were frequently taken for jewels. What materials the ancients used for colouring glass is unknown; but it is certain that metallic calces must have been employed, as these pigments alone, are capable of withstanding the heat of the glass furnaces.

The process of tinging glass and enamels, by preparations of gold, is first detailed by Neri, in his *Art of Making Glass*, published in 1611, which was improved upon by the gold calx or precipitate, invented by Kulkel, who, about the year 1680, made a cup of ruby glass for the Elector of Cologne, weighing not less than twenty-four pounds, a full inch in thickness, and of an equally beautiful colour throughout. Drinking-glasses with gilt edges, were first manufactured at Bohemia and other places in Germany.

Painting on glass and in enamel may, in certain respects, be considered as branches of the art of colouring glass: originally it consisted in the arrangement of pieces of glass of different colours, in some sort of symmetry, constituting a kind of Mosaic work; afterwards, when an attempt was made to represent figures, and to delineate the different shades of their draperies, the figures were drawn in black, with water colours, and the draperies attached to it by separate glasses of the colour required. About the year 1500, a French painter at Marseilles, discovered a method of incorporating the coloured drawings themselves on the glass, by exposing it to a proper degree of heat after the colours had been laid on; and this invention was considerably improved upon, by Albert Durer, and Lucas of Leyden.

This art is supposed to have been introduced into England in the reign of John, and was at first exercised by ordinary tradesmen, from plans drawn by artists. Walpole produces instances of it in the reign of Henry III.; and he traces the history of it from the Reformation, (when misguided zeal destroyed most of the monuments of it in our churches,) through a series of professors to the present time.

The art of cutting or engraving on glass by means of the lapidary's wheel is noticed by Pliny, and was revived by Caspar Lehmann, in the beginning of the seventeenth century. The diamond is first mentioned as being applied to this purpose by Francis I. of France; soon after which, festoons and other ornaments, cut with a diamond, became extremely common on the Venetian glasses. Previous to this discovery, emery and sharp-pointed instruments of hard steel, and sometimes a red-hot iron, were used by the glaziers for the purpose of dividing the glass.

A method of forming glass to resemble *porcelain*, by reducing it to a less vitrified state, was invented by Reaumur, about 1740.

The property which glass possesses, in common with other substances, of being extended by heat and contracted by cold, was communicated by Hooke to the Royal Society, in 1660.

Musical glasses are of German origin, and were introduced into England in 1760.

[*White's History of Inventions.*

History of Bells.

Any attempt to trace the origin of bells would be useless, those of a small size being very ancient. According to the Mosaic law, the lower part of the blue robe worn by the high priest in religious ceremonies, was to be adorned with pomegranates, and gold bells, intermixed at equal distances, which it is conjectured was meant to give notice of his approach to the sanctuary, and thus escape the punishment of death, annexed to an indecent intrusion. At first, bells seem to have been appropriated to religious purposes, and were common in all the heathen temples; afterwards the Greeks and Romans used them for civil and military purposes.

Saint Paulinus, who about the year 400, was bishop of Nola, in Campania, is said to be the first who introduced bells into churches, previous to which the Christians made use of rattles, "sacra ligna," to call the congregation together, no bells being allowed by government to a proscribed sect; hence bells were called by the Romans, nolæ, and sometimes campanæ.

It is said that bells of a *large* size were applied to ecclesiastical purposes, in some of the monastic societies of Caledonia, so early as the sixth century: they are noticed by the venerable Bede in 670, and appear to have been common, from the first erection of parish churches in this kingdom. Ingulphus informs us that Terketulus, abbot of Croyland, who died about the year 870, gave a great bell to the church of that abbey, which he named Guthlac, and it is stated that St. Dunstan, about the year 970, cast two of the bells of Abingdon Abbey, with his own hands.

The Chinese were formerly celebrated for the magnitude of their bells: at Nankin there was one twelve feet high, seven and a half in diameter, and twenty-three feet in circumference—but this has been greatly surpassed by one made at Moscow, by order of Anne, late empress of Russia, which is stated by Mr. Cox to have been nineteen feet high, sixty-three feet eleven inches in circumference, and twenty-three inches thick, and weighing 432,000 lbs.

Brand says the custom of *muffling* bells was introduced into this country soon after the restoration; and that the use of bells in the time of mourning was formerly prohibited.

The *passing-bell*, according to Mabillon, anciently served two purposes: one of which was engaging the prayers of all good people for departing souls; and the other was, driving away the evil spirits which were supposed to haunt the bed and house, and ready to seize their prey, but kept at a distance by the ringing of this bell. Durand, in his Ritual, written about the end of the twelfth century, speaks of it as an old and well-established custom:—

When thou dost hear a toll or knell,
Then think upon *thy* passing-bell.

The bell of St. Sepulchre's commenced tolling for prisoners, on the morning of their execution, in 1605.

The custom of *baptizing* bells is very ancient: before bells were hung they were washed, crossed, blessed, and named by the bishop, generally after some saint, that the people might think themselves summoned to divine service by the voice of the saint whose name the bell bears: this practice was, however, prohibited by Charlemagne in 789, but was soon afterwards revived, and on the restoration of the Bourbon dynasty, the bell of the church of Notre Dame at Paris, was regularly baptized, and received the name of the Duke and Dutchess of Angouleme, on the 15th of November, 1816.

The practice of *ringing the bells in changes*, or regular peals, is said to be peculiar to the British nation—whence Britain has been termed the ringing island. This custom seems to have originated with the Anglo-Saxons. Ingulphus states, that besides the large bell before noticed, as having been given by Terketulus to Croyland Abbey, he also, some time afterwards, gave six other bells, all of which rang together, and were the first tunable bells in England;

and it is certain this diversion was common in England long before the Conquest. There are now several societies of ringers in London, particularly one known by the name of the College Youths, of which Sir Matthew Hale, lord chief-justice of the court of King's Bench, was in his younger days a member.

The uses of bells are summed up in the following Latin distich:—

> Laudo Deum verum, plebem voco, congrego elerum,
> Defunctos plero, pestem fugo, festa decoro.

The Mahometans make no use of bells, considering them as profane; but the people are summoned to the mosques by the voice of the public crier, from one of the towers, or minarets. *Ib.*

Of Animal Strength.

[From the Library of Useful Knowledge.]

Under the direction of a society established in London, '*For the diffusion of useful knowledge*,' a number of small, distinct treatises are now in the course of publication, which have for their object, a clear explanation of those branches of science, which are most intimately connected with the useful arts. Although we think that they are, upon the whole, susceptible of much improvement, by the use, in many instances, of a more familiar and popular style, the work is yet very excellent; and we shall make frequent selections from it, of such portions as we may deem most useful. Editor.

One of the most obvious, and, therefore, one of the earliest, although, perhaps, the least efficient of the prime movers, is *animal strength.*

From our ignorance of the nature and principle of animal life, it is evident that we cannot attempt to explain, on scientific principles, the laws which regulate animal strength: and, on the other hand, owing to the very fluctuating nature of this force, the various physical causes which produce differences in its manifestations in different individuals, and even in the same individual, at distances of time by no means great, considerable difficulties obstruct the investigation and development of these laws by the process of actual observation and experiment. The whole analogy of nature, the beauty, order, and singular harmony of all her works, however, convince us that this force, like every other, is regulated by fixed laws.

To simplify our investigations, we shall consider every exertion of animal strength to be represented by that which is necessary to carry a load or weight. It is not difficult to imagine, that, in whatever way strength be used, we can find a certain load carried with a certain speed, which may be considered as an equivalent exertion.

In estimating the exertion of animal strength in this way, one law is very obvious, which is, that as the load is increased (all other things being the same,) the velocity of the animal must necessarily be diminished. But, then, it becomes a more difficult matter to determine in what proportion the velocity should be diminished with a given increase of load, in order that the expenditure of animal labour should be the same. Different formulæ have been suggested, each agreeing more or less with experience, and we shall here attempt to explain, in a popular way, that formula which seems to represent the results of experiments most accurately.

There are two extreme cases of animal exertion. There is a certain speed at which the animal can carry no load, and can barely move its own body; let this speed be called X. There is some load so great that the animal can barely sustain it, without being able to move it; call this load L. What is technically called the *useful effect* depends on two things—the *load* which is borne, and the speed or velocity with which it is carried. The useful effect is, in fact, estimated by multipling the load by the speed. This will be easily understood by an example. Suppose one horse carry two hundred weight six miles an hour, and another carry three hundred weight four miles an hour. The load of the former is two, and the speed six; the product, or useful effect, being twelve. The load of the latter is three, and the speed four; the useful effect being twelve. The propriety of considering the useful effect to be equal in these two cases, will appear very evidently, if we consider both horses to be employed in transporting weights between two places, distant one mile asunder, for six hours. The first horse will carry in the six hours, 72 hundred weight between the two places, for he will make thirty-six turns, travelling for six hours at six miles an hour, and at each turn he will carry two hundred weight. The other horse will make but twenty-four turns, since he travels only four miles an hour; but then, in each turn, he will carry three hundred weight; and therefore, he will also transport, in the given time, 72 hundred weight between the two places. Thus the useful effects of these horses are equal, and hence the propriety of estimating the useful effect, by the product of the numbers which express the load, and the speed with which that load is carried.

Recurring now to the load L, and the speed X, it is apparent that, with the load L, the useful effect is nothing, because there is no speed; and again, with the speed X, the useful effect is nothing, because there is no load. But with a load less than L, there will be a speed less than X; and, therefore, there will be a useful effect. These, then, are two limiting cases, in which the useful effect vanishes; approaching which, it diminishes; and at some point between which, it is a *maximum*. To determine where this maximum lies, it is necessary that we should know in what proportion the velocity diminishes, as the load increases.

Let l be any load less than L, and let x be the greatest speed with which this load can be carried. The useful effect will be $l \times x$: that is, the load multiplied by the speed. The rule which seems best to agree with experience is, that the load l increases in the same ratio as the square of the difference between the greatest velocity X, with which the animal can move unloaded, and the greatest velocity x with which it can move the load; that is, l increases as $(X - x)^2$.

Assuming this rule, therefore, it follows, that the useful effect is represented by the product $(X - x)^2 \times x$. This will probably be more easily understood by reducing it to an arithmetical table. Let us suppose that the number 15 represents the greatest unloaded speed, and that the square of 15, or 225, represents the greatest load which can be sustained without moving. The signification of the units which compose the number 15, will be found, by dividing the space through which the animal would move in a given time, suppose one hour, into 15 equal parts: each of these parts will be expressed by a unit of the number 15, which expresses the greatest unloaded speed; and the signification of the units of 225 will be found, by dividing the greatest load which can be sustained without moving, into 225 equal parts: one of these parts will be expressed by a unit of the number 225, which expresses the greatest load. The following table gives for each degree of speed from 1 to 15, the corresponding load, and useful effect.

Speed - -	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Load - -	225	196	169	144	121	100	81	64	49	36	25	16	9	4	1	0
Useful effect	0	196	338	432	484	500	486	448	392	324	250	176	108	52	14	0

From the inspection of this table, it appears that a much greater useful effect is to be attained, by the slower motions with heavier loads, than by the quicker motions with lighter loads. The greatest useful effect is produced by the speed 5 with the load 100; that is, with a velocity which is one-third of the greatest unloaded speed, and a load, which is four-ninths of the greatest load which can be sustained without moving. We shall find this result, whatever be the number we take, to represent the greatest speed.[*]

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[*] The mathematical investigation is not difficult. Let u be the *useful effect.* Then by the empirical formula already explained we have $u = (X-x)^2 x$. Differentating this we obtain

$$\frac{du}{du} = (X - x)^2 - 2(X - x)x.$$

Supposing this $= 0$ we shall obtain the value of x, which corresponds to a maximum or minimum value of u. This gives the equation,

$$(X-x)(X-3x) = 0$$

the roots of which are

$$x = X \qquad x = \tfrac{1}{3}X.$$

For $x = X$ the load and useful effect are each $= 0$. This root, therefore, corresponds to a minimum; and for $x = \frac{1}{3}X$ $l = (X - \frac{1}{3}X)^2 = \frac{4}{9}X^2$; that is, the load corresponding to one-third of the greatest speed is $\frac{4}{9}$ of the greatest load; for $L = X^2$. That this is a *maximum* is easily shown by taking the second differential, which gives

$$\frac{d^2u}{dx^2} = -3(X - x) - (X - 3x)$$
$$= -4X + 6x$$

in which, if we substitute $\frac{1}{3}X$ for x we find

$$-4X + 2X = -2X,$$

which, being negative, shows that the value $\frac{1}{3}X$ corresponds to a maximum value of u.

Thus, if the greatest unloaded speed of a horse be 15 miles an hour, and that the greatest weight which he is capable of sustaining without moving, be divided into 225 equal parts, his labour will be most advantageously employed if he be loaded with 100 of these parts, and travels at the rate of 5 miles per hour. If he be thus employed, it will be found that he will carry a greater weight through a given distance, in a given time, than under any other circumstances.

The average value of human strength, considered as a mechanical agent, has been variously estimated. Desaguliers considers that a man can raise the weight of 550 lbs. 10 feet high in a minute, and continue to do so for 6 hours. Smeaton considers that this is too high an average, and thinks that six good English labourers will be required to raise 21,141 solid feet of sea-water, to the height of four feet in four hours. In this case, they will raise very little more than six cubic feet of fresh water each, 10 feet high in a minute. The labourers, whom Smeaton supposes capable of executing this work, he considers to be equal to twice the number of ordinary men. It would, therefore, perhaps, be a fair average value of a man's work to estimate it, for a continuance, at half a hogshead of water raised through 10 feet in a minute.

The efforts of men differ with the manner in which these efforts are employed. It has been shown by Mr. R. Buchanan, that the same quantity of human labour employed in working a pump, turning a winch, ringing a bell, and rowing a boat, are as the numbers 100, 167, 227 and 248.

The most advantageous manner of applying human strength is in the act of rowing.

The most useful of quadrupeds, as a mechanical agent, is the *horse*. The relative values of the labour of a horse and man are variously stated. Some estimate them as five to one, some six to one, and some seven to one. Perhaps the medium may be nearest to the true average, and that we may generally consider six men equivalent to one horse.

The most advantageous method of using the strength of the horse, is in the act of *drawing*. The worst method in which this animal can be employed, is in *carrying* a weight up a steep hill; while, on the other hand, the peculiar disposition of the limbs of a man, renders him well-fitted for this species of labour. It has been observed, that three men climbing a hill, loaded with 100lbs. each, will ascend with greater speed than one horse carrying 300lbs.

On Various Cements.

In our first volume, we published an article under the above title, which we copied from Mr. Gill's Technical Repository. Those which we now give from an early volume of the Philosophical Magazine, were, we believe, principally supplied by the same hand. There are but few artists to whom some of the recipes will not be found of use, and many of them are applicable by every one, to the purposes of domestic economy. We shall hereafter add to the number of similar articles, without regard to the novelty of the processes recommended, our wish being to make extensively known, what experience has proved to be really useful. EDITOR.

Cements for Derbyshire Spar and other Stones.

A cement for this purpose may be made with about seven or eight parts of rosin, and one of bees' wax, melted together, with a small quantity of plaster of Paris. If it is wished to make the cement fill up the place of any small chips that may have been lost, the quantity of plaster must be increased a little. When the ingredients are well mixed, and the whole is nearly cold, the mass should be well kneaded together. The pieces of spar that are to be joined must be heated until they will melt the cement, and then pressed together, some of the cement being previously interposed.

Melted sulphur applied to fragments of stones, previously heated (by placing them before a fire) to at least the melting point of sulphur—and then joined with the sulphur between, makes a pretty firm and durable joining.

Little deficiencies in the stone, as chips out of corners, &c. may also be filled up with melted sulphur, in which some of the powder of the stone has been mixed.—The stone must be first heated.

Temporary Cements, for Turners, &c.

Workmen are often at a loss for such a cement as will hold firmly till they have no further occasion for it, and yet, be easily parted when it is necessary; as in fixing glass plates to blocks to be ground for optical purposes, joining metallic plates to be turned in a lathe, &c. For such purposes, a cement composed of the following ingredients will be found to answer well:

To four ounces of rosin and one-fourth of an ounce of bees' wax melted together, add four ounces of whitening (washed carbonate of lime or chalk,) made previously red hot. The whitening should be put in while yet hot, that it may not have time to imbibe moisture from the atmosphere. This makes a good cement for holding optical glasses on the end of a mandril while grinding, or for similar purposes.

To cement plates of metal to the chucks of a lathe in order to turn them, the chuck should be heated, which is commonly done, by directing the flame of a candle upon it urged by a blow-pipe; the metal should also be heated in the same manner until they will melt the cement applied to them. The pieces, being then placed in contact, are adjusted centrally, while the cement cools, either by holding a pointed stick in a small hole previously made in the centre of the plate by a prick punch, or by pressing a piece of wood laterally against it. When cold, it will be held firm enough, by means of the cement, to bear being turned, and may be disengaged at any time by again heating it.

Pitch, rosin, and a very small quantity of tallow, melted together, and thickened by stirring in dry brick dust, is employed by chasers of gold and silver articles to support and hold their work.

This mixture forms a cheap cement, useful for many purposes, as fixing small steel articles on the blocks destined to hold them for polishing, and is much used at Birmingham. The proportions of the ingredients depend on the heat of the weather, and the particular purpose in view. In winter, a larger portion of tallow is necessary, than in summer.

Shell-lac is a very strong cement for holding metals, glass, or precious stones, while cutting, turning, or grinding them. The metal, &c. should be warmed to melt it.

Bees' wax mixed with a little colcothar, (red oxide of iron,) makes a good polishing tool for lenses: use a little finely-washed colcothar mixed with water for the cutting material, applied between the tool and the lens.

Cement for Glass and China.

White of eggs, mixed up with a little quicklime, (or a bit of chalk burnt in a common fire and pounded,) makes a pretty good cement for glass and porcelain. It is not absolutely necessary that the chalk be burnt, though it is generally used so.

Gum-Arabic Cements.

Gum-arabic, dissolved in as small a quantity of water as may be, and diluted to a proper consistence with gin, or any proof spirit, forms a very useful cement for all purposes where gum-water is commonly used, the spirit preserving it from becoming putrescent. As the spirit evaporates, more should be added. It should be stirred and mixed together at the time of using.—If plaster of Paris be added to gum-water, it makes a cement useful to ladies in filligree works.

Gum-ammoniac added to the solution of gum-arabic in proof spirits very much improves the cement. It answers very well for joining broken glass and ornamental articles of porcelain.

A fine transparent Glue.

Shreds or parings of vellum or parchment, boiled for a sufficient length of time in soft water, dissolve at last into a very transparent glue. White leather, that is, skins dressed with alum instead of being tanned, will answer the same end.

Isinglass Cements.

A useful cement is made of this substance, by either dissolving it in any proof spirit by heat, or by adding to it, when dissolved in water, an equal quantity of alcohol.

An improved cement may be made by adding to the isinglass, previous to its solution in proof spirits, one-third part of its weight of gum-ammoniac. Expose the mixture to a boiling heat, until the isinglass and gum are dissolved, and until a drop of the composition becomes stiff, instantly, as it cools. It will at any future time melt with a degree of heat little exceeding that of the human body, and, in consequence of so soon becoming stiff on cooling, forms a very valuable cement for many purposes, particularly for the very nice and delicate one of fixing on the antennæ, legs, &c. of insects in cabinets of natural history.

The easy melting of this cement is no objection to its use, in cases where the articles themselves may afterwards be exposed to moderate heat; for it owes this property only to the presence of the alcohol, which evaporates very soon after it has been applied.

When used to join broken glass or china, the pieces to be joined should be previously warmed. Immersion in hot water will give them a sufficient degree of heat. Wipe off the water before applying the cement, which may be laid on with a pencil: then press the pieces together, binding them with a string, or a bit of soft wire, if necessary.

Japanese Cement, or Rice Glue.

This elegant cement is made by mixing rice flour intimately with cold water, and then gently boiling it. It is beautifully white, and dries almost transparent. Papers pasted together by means of this cement, will sooner separate in their own substance than at the joining, which makes it extremely useful in the preparation of curious paper articles, as tea trays, ladies' dressing boxes, and other articles which require layers of paper to be cemented together. It is in every respect preferable to common paste made with wheat flour, for almost every purpose to which that article is usually applied. It answers well, in particular, for pasting into books the copies of writings taken off by copying machines on unsized silver paper.

With this composition, made with a comparatively small quantity of water, that it may have a consistence similar to plastic clay, models, busts, statues, basso-relievos, and the like, may be formed. When dry, the articles made of it are susceptible of a high polish: they are also very durable.

The Japanese make quadrille-fish of this substance, which so nearly resemble those made of mother-of-pearl, that the officers of our East Indiamen are often imposed upon.

Glue of the Laplanders.

The bows of the Laplanders are composed of two pieces of wood, glued together; one of them of birch, which is flexible, and the other of fir of the marshes, which is stiff, in order that the bow when bent may not break, and that when unbent it may not bend. When these two pieces of wood are bent, all the points of contact endeavour to disunite themselves, and to prevent this, the Laplanders employ the following cement:—They take the skins of the largest perches,* and, having dried them, moisten them in cold water, until they are so soft that they may be freed from the scales, which they throw away. They then put four or five of these skins in a rein-deer's bladder, or they wrap them up in the soft bark of the birch-tree, in such a manner that water cannot touch them, and place them, thus covered, into a pot of boiling water, with a stone above them to keep them at the bottom. When they have boiled about an hour, they take them from the bladder, or bark, and they are then found to be soft and viscous. In this state they employ them for glueing together the two pieces of their bows, which they strongly compress and tie up until the glue is well dried. These pieces never afterwards separate.—*Transactions of the Academy of Sciences at Stockholm.*

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* It is probable eel-skins would answer the same purpose.

Jewellers' Cement.

In setting precious stones, pieces are sometimes broken off by accident. In such cases, they often join the pieces so correctly, that an inexperienced eye cannot discover the stone to have been broken. They employ for this purpose a small piece of gum-mastich applied between the fragments, which are previously heated sufficiently to enable them to melt the interposed gum. They are then pressed together, to force out the redundant quantity of gum.

In the same manner cameo heads, but without any ground, made of paste (white enamel or coloured glass) are often cemented on a piece of real stone to serve them for a ground, producing the appearance of a real onyx, from which they can with difficulty be sometimes distinguished.

Backs are also cemented to stones in the same manner, to change their hue. That is, behind a transparent stone, the colour of which is wished to be altered, a thin plate of a stone of a different colour is cemented, which alters the colour of the refracted light to a mixed tint, partaking of that of both. In this case, the surfaces to be joined are previously ground as flat and true as possible. They are called *doublets.*

Turkey Cement for joining Metals, Glass, &c.

The jewellers in Turkey, who are mostly Armenians, have a curious method of ornamenting watch-cases, and similar things, with diamonds and other stones, by simply glueing them on. The stone is set in silver or gold, and the lower part of the metal made flat, or to correspond with the part to which it is to be fixed; it is then warmed gently, and the glue applied, which is so very strong, that the parts never separate. This glue, which may be applied to many purposes, as it will strongly join bits of glass or polished steel, is thus made:

Dissolve five or six bits of mastich, as large as peas, in as much spirit of wine as will suffice to render it liquid; in another vessel dissolve as much isinglass (which has been previously soaked in water till it is swollen and soft,) in French brandy or in rum, as will make two ounces, by measure, of strong glue, and add two small bits of gum-galbanum or ammoniacum, which must be rubbed or ground till they are dissolved: then mix the whole with a sufficient heat; keep it in a phial, stopt, and when it is to be used, set it in hot water.—*Eton's Survey of the Turkish Empire.*

The process above described may be simplified by adding the gum-ammoniac to the isinglass, during its solution in proof spirit, and exposing the mixture to a boiling heat until it is dissolved, when the solution of mastich in alcohol may be added. The gum-ammoniac previously dissolved with the isinglass, promotes the union of the mastich with the mucilage. This cement has been tried in London, and found to answer well: it stands against moisture.

Cements which resist Moisture.

Generally speaking, all cements into the composition of which gum-lac or mastich enters, of which we have already given some, possess this property.

A cement of this kind may be made by dissolving isinglass in proof spirit, to which must afterwards be added a solution of shell-lac in alcohol.

Another cement, which will also resist moisture, may be formed by melting by heat, without water, common glue with half its weight of rosin, to which must be added some red ochre to give it body; it is particularly useful for cementing hones to their frames.

Carpenters employ a cement in framing sign-boards, &c. to stand the weather, which they make by adding to a pint of well made common glue, (made with water,) an eighth part of that quantity of boiled linseed oil, dropping it into the glue, gently, and stirring it all the time.

White lead ground up with boiled linseed oil to the consistence of paint, makes a good cement for joining broken porcelain, earthen ware, and glass articles destined to hold water, &c. After the cement is applied between the pieces, they should be pressed home to each other as close as possible; the closer the better; nor need any fears be entertained that enough of cement will not be left in the joint; for the thinnest film that can be interposed, will hold firmer than a thicker one would. The articles should remain undisturbed for two or three months, and before using them, the cement sticking on the outside of the joint should be carefully scraped off with a knife.

A Cement that hardens under Water.

Mr. Gad, in the 32nd volume of the Memoirs of the Academy of Stockholm, states, that if clay and calces (oxide) of iron, be plentifully mixed with oil, they will form a mass which will harden, even under water.

A Glue insoluble in Water.

Leather-dressers' or glovers' glue, that of fish, and that prepared with linseed oil, ceruse, and red lead, which cements pretty strongly glass, stone, and wood, still leave room to wish for one of a stronger quality.

An excellent glue may be procured from cheese. Take skim-milk cheese, free it from the rind, cut it in slices, and boil it in warm water, stirring it with a spoon until it be reduced to a strong glue, which does not incorporate with water. Then throw away the warm water, pour cold water over the glue, and knead it afterwards in warm water, subjecting it to the same process several times. Put the warm glue on a grinding stone, and knead it with quicklime until you have a good glue. When you wish to use this glue you must warm it: if it be employed cold it is not so strong, but it may also be used in that manner. This glue is insoluble in water as soon as it is dry, and it becomes so in forty-eight hours after it has been applied. It may be used for glueing wood, and for cementing marble, and broken stone, and earthenware. The joining can scarcely be discovered.

Baits also for catching fish may be made of it. Fish are very fond of it, and it resists water. Boerhaave observed that no menstruum dissolved cheese, not even aqua-regia.—*Transactions of the Academy of Sciences at Stockholm.*

A Cement that will stand against boiling Water, and even bear a considerable pressure of Steam.

In joining the flanches of iron cylinders and other parts of hydraulic, and steam, engines, great inconvenience is often experienced from the want of a durable cement.

Boiling linseed oil, litharge, red and white lead, mixed together to a proper consistence, and applied on each side of a piece of flannel, previously shaped to fit the joint, and then interposed between the pieces, before they are brought home (as the workmen term it) to their place, by the screws or other fastenings employed, make a close and durable joint.

The quantities of the ingredients may be varied without inconvenience, only taking care not to make the mass too thin with the oil. It is in many cases difficult to make, at once, a good fitting of large pieces of iron work, which renders it necessary sometimes to join and separate the pieces repeatedly, before a proper adjustment is obtained. When this is expected, the white lead ought to predominate in the mixture, as it dries much slower than the red. A workman, knowing this fact, can be at little loss in exercising his own discretion in regulating the quantities. It is safest to err on the side of the white lead, as the durability of the cement is no way injured thereby, only a longer time is required for it to dry and harden.

When the fittings will not admit easily of so thick a substance as flannel being interposed, linen may be substituted, or even paper, or thin pasteboard; the only reason for employing any thing of the kind being the convenience of handling.

This cement answers well also for joining broken stones, however large. Cisterns built of square stones, put together with this cement, will never leak or want any repairs. In this case, the stones need not be entirely bedded in it; an inch, or even less, of the edges that are to lie next the water, need only be so treated: the rest of the joint may be filled with good lime.

Another Cement that will stand the action of boiling Water and Steam.

This cement, which is preferable even to the former, for steam-engines, is prepared as follows:

Take two ounces of sal-ammoniac, one ounce of flowers of sulphur, and 16 ounces of cast-iron filings or borings. Mix all well together by rubbing them in a mortar, and keep the powder dry.

When the cement is wanted for use, take one part of the above powder, and twenty parts of clean iron borings or filings, and blend them intimately by grinding them in a mortar. Wet the compound with water, and, when brought to a convenient consistence, apply it to the joints with a wooden, or blunt iron, spatula.

By a play of affinities, which those who are at all acquainted with chemistry will be at no loss to comprehend, a degree of action and re-action takes place among the ingredients, and between them and the iron surfaces, which at last causes the whole to unite as one mass. In fact, after a time, the mixture and the surfaces of the flanches become a species of pyrites, (containing a very large proportion of iron,) all the parts of which cohere strongly together.

Another Cement of the same kind.

Take two parts of flowers of sulphur and one part of sal-ammoniac, and mix them together, with a little water, into a stiff paste.

Take also borings or turnings of cast-iron, in the state in which they are commonly found in works where boring and turning are carried on, viz. mixed with sand, and sift them finely to get rid of the grosser particles.

When the cement is wanted for use, dissolve a portion of the above paste in urine, or in water rendered slightly acidulous, and to the solution add a quantity of the sifted borings. This mixture, spread upon or between flanches of iron pipes, or put into the interstices of other parts of iron work, will, in a little time, become as hard as a stone.

Blood Cement.

A cement often used by coppersmiths, to lay over the rivets and edges of the sheets of copper in large boilers, to serve as an additional security to the joinings, and to secure cocks, &c. from leaking, is made by mixing pounded quicklime with ox's blood. It must be applied fresh made, as it soon gets so hard as to be unfit for use.

We believe, if the properties of this cement were duly investigated, it would be found useful for many purposes to which it has never been yet applied. It is extremely cheap, and very durable.

On a Method of making Cement for Terraces; and the Use of liquid Pitch to render them impermeable to water, and secure from the Attacks of Frost. By CASIMIR PUYMAURIN.

I SHALL not speak of the nature of the different lime-cements hitherto known, as they have been fully described by various authors; I shall only observe, that a cement ought to be hard, solid, and impermeable. To obtain a hard and solid cement, it has been necessary to employ different bodies, which, by their aggregation with lime, dissolved in water, speedily absorb the superabundant moisture, and furnish to the particles of lime, diffused throughout the cement, the carbonic acid, necessary for rendering it solid, and regenerating it into calcareous earth.

Vitrified lava, natural and artificial puzzolana, the scoriæ of furnaces, pounded bricks, bone-ashes, have been the bases of all the cements hitherto made, and they have been obtained more or less solid. Cements composed in this manner have been attended with perfect success in the southern parts of Europe, little exposed to rain: they do not absorb the exterior moisture, and the frost has not power to dilate their pores, or to destroy their aggregation.

The cements of Italy, Africa, Spain, and other warm countries, unite all those qualities which can be desired by the most exact observer; but in our rainy countries, exposed to very strong frosts, cements ought to possess a more essential quality than hardness or solidity, that is to say, impermeability. Cements composed of porous bodies, cannot possess this quality: being hard, and having their greatest solidity during summer, the rains of autumn gradually penetrate to their interior parts, to reduce to powder that mass which a little before had the appearance of the greatest hardness.

The inventors of the most celebrated cements, have seen their experiments fail, because they neglected this essential quality. The interposition of a fat body was long ago employed. Pliny and Vitruvius recommend the thick part of oil, and oil itself; but these bodies employed alone, can never answer the intended purpose. Oil with the lime of cement, forms a saponaceous body, soluble in water: the thick part of oil contains a very large quantity of mucilage, which water dissolves or carries off.

To preserve the bottoms of vessels, and to render them impermeable to water, resinous bodies have been employed, and particularly liquid pitch. I have thought that my cement should be covered with boiling pitch, as this resinous body penetrates its pores and renders it impermeable to water. One inconvenience, however, appeared in the use of pitch, which is, its property of becoming soft during the heat of summer. This inconvenience I remedied by besprinkling the pitch with powder of lime: the lime combines with the pitch, and forms on the cement, an exterior stratum of new cement, resembling the famous cement of the Romans called *maltha*.

All the merit of my labour, consists merely in having first employed, for preserving cements and rendering them impermeable, a fat body capable of penetrating them, of filling up their pores, and of being insoluble in water.

I shall here give the method which I employ for making my cement; but I must first observe, that there cannot be one general method of composing cements, unless limestone and sand were every where of the same quality. The observer, therefore, must examine the nature of the composition of the lime he employs, and particularly the purity of the sand and siliceous matters: he may then vary the doses of the materials of his cement as may be necessary.

Every method of making cement requires, in general, that the puzzolana, pounded brick, and scoriæ, be reduced to fine powder, and sifted. This precaution is necessary for cement which is not to be covered with a resinous body: its surface thereby, becomes smoother and more compact, and it is less liable to be penetrated by moisture. But this advantage is more than compensated by the fissures and cracks, occasioned by the shrinking of the cement. This shrinking does not take place, in cement made according to my method, because I employ all the matters, hard, coarsely pounded, and in fragments of the size of a grain of wheat, and often as large as peas. These fragments broken in this manner, present a great number of angles and cavities, into which the calcareous part penetrates, and thus forms a kind of connected chain, which prevents those cracks and fissures, so prejudicial to cement. The lime which I employed was made from hard and white limestone of the hill of Cazeres, in the department of the Upper Garonne: this lime dissolves with a sort of ebullition and a great heat, and, after its solution, forms a white paste without any mixture of gravelly parts: it is susceptible of swallowing, as the masons here term it, a great deal of sand and other hard matters, but it has less strength in the open air than meagre lime, which being made from marly stone, contains in its composition a great many baked and vitrified argillaceous matters, which give it great strength when exposed to the open air and to water. This lime, called in the country *chaux de Bourret*, requires little sand, because the calcined and vitrified earthy parts which it contains, form with it already an intimate mixture, or a kind of cement: this lime, therefore, dissolved in water, acquires, in a little time, the hardness of stone.

The lime I employed then was perfectly pure, without any internal mixture of heterogeneous parts, but which had no great solidity when exposed to the open air.

I found that a fifth part of lime was sufficient, to give to cement that connecting quality, necessary to envelop all the vitrified and siliceous parts of a calcareous stratum, and, consequently, to give it the greatest solidity. Such is the process I employed to form on a roof, constructed for two hundred years, the joists of which were at a great distance from each other, a terrace of forty square fathoms, which still exists, and has withstood four severe winters, and our scorching summers.

One precaution which I did not take, and which embarrassed me a good deal, was to pound the limestone before it was employed. The stone dissolves in water; but some stones being less calcined than others, their nucleus does not dissolve, and only becomes penetrated with moisture. When these are blended with the gravel and siliceous matters employed, at the end of some days, the cement blisters, and splits into small fragments, and bits of the lime which have not been dissolved, are found in the state of lime slaked in the open air.

Take two measures of river pebbles well washed, or fragments of brick of the size of a nut; two of tiles and iron scales coarsely pounded, one of river sand perfectly well washed, and a measure of the lime of Cazeres, just from the kiln, and pounded.

Form a circle with the sand, and throw into the hollow, the lime which has been slaked, taking care to mix it thoroughly: when the lime is well diluted leave it in that state for three hours, in order that the whole lime may be dissolved; then mix with it gradually the river pebbles, the iron scales, the tiles, and the sand. This mortar must then be worked for half an hour, that every siliceous stone and fragment of tile may be well incorporated.*

Such is the manner in which I prepare cement. There are two methods of employing it; either above a pavement of brick, or below it. The former appears to be the most solid, during the first year, while the other suffers the rain water to filter through it, but at the end of a certain time it acquires the most perfect solidity.

As time destroys the timber on which the mortar is placed, when a terrace is intended to be made on a floor, it must be coarsely covered with sand and clay: when this covering is dry, another, composed of mortar and pretty fat sand, must be placed over it: there is no necessity for cutting the bricks, and the upper surface must be rough or notched with a chisel. This pavement must have an inclination sufficient to make the water run off.

In the month of July, when the two coverings are very dry, the cement composed in the above manner must be applied in bands of two feet in breadth; two workmen are sufficient. This stratum of cement ought to be from two inches and a half, to three in thickness; the covering on which it is placed, ought to be moistened with milk of quicklime; and the cement must be pressed down closely with the trowel, taking care to beat it with the sharp edge of that instrument. It is smoothed by the back of the trowel slightly moistened. The surface of the cement must be again pressed down, to bury the coarser parts and render the whole smooth. When the first band is finished, the workman proceeds to a second, and the two bands must be carefully united to prevent their separation.

This cement soon dries, and at the end of an hour can sustain a strong pressure. It must, however, be left, seven or eight days; after which the surface of it is to be slightly moistened, and then pressed down and smoothed by means of flat stones, in the same manner as marble is polished. This last precaution is essentially necessary, and the solidity of the cement will depend on the care with which it has been performed. When the terrace has been constructed in this manner, the aggregation of the cement becomes stronger, and its pores are smaller and less numerous.

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* When the cement is almost finished throw over it about a bushel of quicklime in powder. The mortar then becomes very difficult to be stirred. Or two pints of milk of lime are then to be added, which will penetrate the cement in every part.

In order that the cement may succeed perfectly, it must be made during the great heats of July, that the superabundant water may evaporate, and that it may be perfectly dry before the autumnal rains. At the end of August, boil pitch, such as that used for ships, and spread it over the cement by means of large brushes. As this coating would render the cement not fit to be touched during summer, this inconvenience may be remedied in the following manner:—Take lime, slaked in the open air and reduced to fine powder, and, having sprinkled it over the pitch, remove, by means of a broom, the superfluous part of the lime which does not adhere to it. This lime, by combining with the pitch, will form with it a very thin stratum of cement, similar to the maltha of the Romans. At the beginning of October a second stratum of pitch and lime must be laid on.

The second method of employing the cement is to place it immediately over the stratum of brick and clay, and then to cover it with a pavement of brick, mortar, and sand. I have two terraces, fifteen fathoms in length, and one and a half in breadth, which appear to me to have the greatest solidity. They are not so beautiful as those where the cement covers the brick; but they can stand every kind of friction or pressure.

After making a stratum of clay and sand, spread over it a stratum of cement four inches in thickness, well beaten, and add pebbles somewhat larger than those employed in the preceding cement, and increase the dose of lime in proportion: the cement must then be beaten with clubs like those used for smoothing the walks in the neighbourhood of Paris. It is then to be left to dry for a month, after which the surface of it must be moistened with milk of lime; and the bricks are to be placed with good lime and sand.

It is not necessary that these bricks should be ground. I have observed that, by cutting, their strength is lessened, as it destroys their upper, half vitrified surface: nothing then remains below but an earthy surface, which is soon penetrated by moisture, and which is easily destroyed by frost. Care must be taken to fill up the joints with good mortar, which must be pressed in and smoothed by the trowel, and then pitched.

Terraces constructed in this manner, suffer the water for some time to filter through them in small quantity. This water charged with calcareous particles, stops up the pores of the cement; no more filtration takes place: and terraces of this kind have the greatest solidity, and are exceedingly cheap. This cement may be employed with advantage for the interior of apartments; it also may supply the place of pavements of cut bricks, and costs two-thirds less.

It must be spread over a pavement of rough bricks, or bricks picked with an instrument, to the thickness of an inch or nine lines. The pebbles may be omitted, and their place supplied by fragments of tiles and iron scales, coarsely pounded: it is then to be pressed down and smoothed with flat stones, but before it is painted it must be suffered to dry for a month. It is painted and waxed in the same manner as brick pavement.

Such are the details of the cement I have employed, and which has been attended with complete success. But I shall here repeat, that the doses must be varied according to the greater or less purity of the lime and of the other matters employed; and the application of pitch is merely to prevent the infiltration of water, and the destruction of the cement by frost.

ACTIVE AND PASSIVE STRENGTH.

Active Strength, or Animal Energy, as of Men, Horses, &c.

[From Gregory's Mathematics for Practical Men.]

1. The force obtained through the medium of animal agency, evidently varies, not only in different species of animals, but, also, in different individuals. And this variation depends, first, on the particular constitution of the individual, and upon the complication of causes, which may influence it; secondly, upon the particular dexterity acquired by habit. It is plain, that such a variation cannot be subjected to any law, and that there is no expedient to which we can have recourse, but that of seeking mean results.

Secondly, the force varies according to the nature of the labour. Different muscles are brought into action, in different gestures and positions of an animal which labours; the weight itself, of the animal machine, is an aid in some kinds of labour, and a disadvantage in others: whence it is not surprising, that the force exerted, is different, in different kinds of work. Thus the force exerted by a man is different, in carrying a weight, in drawing, or pushing it horizontally, and in drawing, or pushing it vertically.

Thirdly, the force varies according to the duration of the labour. The force, for example, which man can exert in an effort of a few instants, is different from that, which he can maintain equably, in a course of action continued, or interrupted only by short intervals, for a whole day of labour, without inducing excessive fatigue. The former of these, may be called *Absolute Force*, the latter *Permanent Force*. It is of use to become acquainted with them both, as it is often advantageous, to avail ourselves sometimes of the one, sometimes of the other.

Lastly, the force varies according to the different degrees of velocity, with which the animal, in the act of labouring, moves either its whole body, or that part of it which operates. The force of the animal is the greatest, when it stands still; and becomes weaker as it moves forward, in proportion to its speed; the animal acquiring, at last, such a degree of velocity, as renders it incapable of exerting any force.

2. Let ϕ be a weight equivalent to the force, which a man can exert, standing still; and let V be the velocity with which, if he proceeds, he is no longer capable of exerting any force: also, let F be a weight equivalent to the force which he exerts, when he proceeds, equably, with a velocity v.

Then F will be a function of v, such that, 1st, it decreases, whilst v increases; 2ndly, when $v = 0$, then $F = \phi$; 3dly, when $v = V$, $F = 0$.

3. Upon the nature of this function, we have the three following suppositions:

1. $F = \phi . \left(1 - \frac{v}{V}\right).$ (Bouguer, *Man. des Vais.*)

2. $F = \phi . \left(1 - \frac{v^2}{V^2}\right).$ (Euler, *Nov. Comm. Pet.* tom. III.)

3. $F = \phi . \left(1 - \frac{v}{V}\right)^2$ (Ib. tom. VIII; and *Act. of Rowers.*)

4. *Coroll.* 1. The effect of the permanent force, being measured by the product $F\,v$, the expression for the effect will be one of the three following, accordingly as one or other of the suppositions is adopted.

1. $F\,V . \left(1 - \frac{F}{\phi}\right)$, or $\phi\,v \left(1 - \frac{v}{V}\right).$

2. $F\,V . \sqrt{\left(1 - \frac{F}{\phi}\right)}$, or $\phi\,v \left(1 - \frac{v^2}{V^2}\right).$

3. $F\,V . \left(1 - \sqrt{\frac{F}{\phi}}\right)$, or $\phi\,v \left(1 - \frac{v}{V}\right)^2.$

5. *Coroll.* 2. To know the weight, with which a man should be loaded, or the velocity, with which he ought to move, in order to produce the greatest effect, we must make $d \,.\, Fv = 0$.

Whence we shall have.

1. $F = \frac{1}{2}\phi$; and $v = \frac{1}{2}V$.

2. $F = \frac{2}{3}\phi$; and $v = \frac{1}{\sqrt{3}} . V = 0.5773\,V$.

3. $F = \frac{4}{9}\phi$; and $v = \frac{1}{3}V$.

6. *Coroll.* 3. And the value of the greatest effect will be, according to the 1st hypothesis.............. $= \frac{1}{4}\phi\,V$:

.... 2nd. .... $= \frac{2}{3\sqrt{3}}\phi\,V = 0.3836\,\phi\,V$:

.... 3d. .... $= \frac{4}{27}\phi\,V$.

But which of the three suppositions ought we to prefer? And are we certain that either of them approximates to the true law of nature?

M. Schulze made a series of experiments with a view to the determination of this point,* and with regard to men, decided in favour of the last of Euler's formulæ:

$$\text{viz. } F = \varphi\left(1 - \frac{v}{V}\right)^2.$$

As the experiments of this philosopher are very little known in England, I shall here present his brief account of them.

7. To make the experiments on human strength, he took at random, 20 men of different sizes and constitutions, whom he measured and weighed. The result is exhibited in the following table.

Order.	Height.			Weight.	Order.	Height.			Weight.
1	5′	3″	4‴	122	11	5′	9″	7‴	132
2	5	2	3	134	12	5	1	4	157
3	5	7	2	165	13	5	3	2	175
4	5	5	0	131	14	5	4	1	117
5	5	11	2	177	15	5	10	8	192
6	6	0	4	158	16	5	0	3	133
7	5	8	3	180	17	4	11	2	147
8	5	2	1	117	18	5	3	9	124
9	5	4	8	140	19	5	6	0	163
10	5	0	4	126	20	5	10	1	181

Here the heights are expressed in feet, (marked ′) inches, (″) twelfths, (‴) the feet being those of Rhinland, each 12.35 English inches. The weights are in pounds, which are to our avoirdupois lbs. as 30 to 29.

To find the strength that each of these men might exert to raise a weight vertically, Mr. Schulze made the following experiments:

He took various weights, increasing by 10 lbs., from 150 lbs. up to 260 lbs.; all these weights were of lead, having circular and equal bases. To use them with success, in the proposed experiments, he had at the same time a kind of bench made, in the middle of which, was a hole of the same size of the base of the weights: this hole was shut by a circular cover when pressed against the bench; at other times it was kept at about the distance of a foot and a half above the bench, by means of a spring and some iron bars. To prevent the weight with which this cover was loaded, during the experiment, from forcing down the cover, lower than the level of the surface of the bench, he had several grooves made in the four iron bars, which sustained the cover, and which at the same time, served to hold up the cover, at any height where it might arrive by the pressure of the springs, as soon as the pressure of the weight ceased.

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* Mem. Acad. Scienc. Berlin, for 1783.

After having laid the 150 lbs. weight on the cover, and the other weights in succession, increasing by 10 lbs., up to 250 lbs., he made the following experiments with the men whose size and weight are given above, by making them lift up the weights as vertically as possible, all at once, and by observing the height to which they were able to lift them. The annexed table gives the heights observed for the different weights marked at its head.

	150		160		170		180		190		200		210		220		230		240		250
	''	'''	''	'''	''	'''	''	'''	''	'''	''	'''	''	'''							
1	7	9	6	4	4	11	4	4	3	8	2	8	1	1							
2	7	10	6	6	5	7	4	7	3	11	2	5	0	5	''	'''	''	'''			
3	7	9	7	3	6	5	5	9	4	11	4	0	3	0	1	7	0	3	''	'''	
4	8	3	7	6	7	2	5	10	5	3	4	7	4	0	3	8	3	1	1	4	
5	12	4	11	1	9	7	8	5	7	10	7	1	5	10	4	7	3	2	1	3	
6	14	5	14	0	13	5	12	8	11	5	10	1	8	6	6	6	4	1	0	1	
7	12	11	11	3	10	5	9	3	8	1	6	9	5	3	3	8	1	11	0	2	
8	11	9	10	2	9	4	8	11	8	1	6	11	5	10	5	1	3	2	1	0	
9	9	5	8	3	7	1	5	6	4	1	2	9	1	3							
10	8	1	6	5	4	7	3	9	2	5	1	7	0	4							

This table proves that the size of the men employed to raise the weights vertically, has considerable influence on the height to which they brought the same weight. We find, also, that the height diminishes in a much more considerable ratio, than the weight increases: and we may therefore conclude, that it is advantageous to employ large men when it becomes necessary to draw, vertically, from below upwards: and on the contrary, it is more advantageous to employ men of a considerable *weight*, when it is required to lift up loads by means of a pulley, about which a cord passes, that the workmen draw in a vertical direction, from above downwards. To find the absolute strength of these men, in a horizontal direction, Mr. Schulze proceeded thus:

Having fixed over an open pit, a brass pulley extremely well made, of 15 inches diameter, whose axis, made of well polished steel to diminish the friction, was $\frac{3}{4}$ inch in diameter; he passed over this pulley a silk cord, worked with care, to give it both the necessary strength and flexibility. One of the ends of this cord carried a hook to hang a weight to it, which hung vertically in the pit, whilst the other end was held by one of the 20 men, who, in the first order of the following experiments, made it pass above his shoulders; instead of which, in the second, he simply held it by his hands.

Mr. S. had taken the precaution to construct this in such a manner, that the pulley might be raised or lowered at pleasure, in order to keep the end of the cord, held by the man, always in a horizontal direction, according as the man was tall or short, and exerted his strength in any given direction.

He had made the necessary arrangements, so as to be able to load, successively, the basin of a balance, which was attached to the hook at the end of the cord, which descended into the pit, whilst the man who held the other end of this cord, employed all his strength without advancing or receding a single inch.

The following table, gives the weights placed in the basin when the workmen were obliged to give up, having no longer sufficient strength to sustain the pressure occasioned by the weight. To proceed with certainty, Mr. S. increased the weight each time, by five pounds, beginning from 60, and took the precaution to make this augmentation in equal intervals of time; having always precisely a space of 10 seconds between them. The result of these observations repeated several days in succession, is contained in the following tables.

I. When the cord passed over the shoulders of the workmen.

Order.	lbs.	Order.	lbs.	Order.	lbs.	Order.	lbs.
1	95	6	100	11	95	16	95
2	105	7	115	12	100	17	100
3	110	8	105	13	110	18	90
4	100	9	95	14	90	19	100
5	105	10	90	15	110	20	100

II. When the cord was simply held before the man:

Order.	lbs.	Order.	lbs.	Order.	lbs.	Order.	lbs.
1	90	6	100	11	90	16	90
2	105	7	110	12	90	17	90
3	105	8	100	13	100	18	85
4	90	9	90	14	85	19	100
5	95	10	85	15	105	20	100

These two tables show, that men have less power in drawing a cord before them, than when they make it pass over their shoulders; they show, also, that the largest men have not always the greatest strength to hold, or to draw in a horizontal direction, by means of a cord. To obtain the absolute velocity of these 20 men, Mr. S. proceeded as follows:

Having measured very exactly a distance of 12000 Rhinland feet in a plain nearly level, he caused these 20 men to march with a fair pace, but without running, and so as to continue during the period of four or five hours; the following is the time employed in describing this space, with the velocity resulting for each of them.

Order.	Time.	Veloc.	Order.	Time.	Veloc.	Order.	Time.	Veloc.
1	40.18	4.94	8	40. 9	4.99	15	36.17	5.51
2	41.12	4.85	9	40.20	4.96	16	41.28	4.82
3	39. 8	5.55	10	40.51	4.90	17	42.25	4.71
4	39.40	5.04	11	36.17	5.51	18	40.19	4.98
5	34.19	5.83	12	38.11	5.24	19	39.57	5.01
6	35.11	5.68	13	38. 5	5.25	20	37.51	5.29
7	38. 7	5.25	14	37. 1	5.40			

It is necessary to mention, with regard to these experiments, that Mr. Schulze took care to place at certain distances, persons in whom he could place confidence, in order to observe whether these men marched uniformly, and sufficiently quick, without running.

Having thus obtained, not only the absolute force, but the absolute velocity also, of several men, he took the following method to determine their relative force.

He made use of a machine, composed of two large cylinders of very hard marble, which turned round a vertical cylinder of wood, and moved by a horse, which described in his march a circle of 10 Rhinland feet. This machine appeared the most proper to make the subsequent experiments, which serve to determine the relative strength that the men had employed to move this machine, and which is used hereafter, to determine which of Euler's two formulæ ought to be preferred.

To obtain this relative force, he took here the same pulley which served in the preceding experiments, by applying a cord to the vertical cylinder of wood, and attaching to the other end of this cord, which entered into an open pit, a sufficient weight to give, successively, to the machine different velocities.

Having applied in this manner, a weight of 215 lbs., the machine acquired a motion, which after being reduced to a uniform velocity, taking into account the acceleration of the weight, of the friction, and of the stiffness of the cord, gave 2.41 feet velocity; and having applied in the same manner a weight of 220 lbs., the resulting uniform motion gave a velocity of 2.47 feet. These two limits are mentioned because they serve as a comparison with what immediately follows: Mr. S. began these experiments with a weight of 100 lbs., and increased it by 5 every time, from that number up to 400 lbs.

He made this machine move by the seven first of his workmen, placing them in such a way, that their direction remained almost always perpendicular to the arm on which was attached the cord, which passed over their shoulders, in an almost horizontal direction.

Thus situated, they made 281 turns with this machine, in two hours, which gave for their relative velocity $v = 2.45$ feet per second. We have also the absolute force, or ϕ, from these 7 men, by the above table = 730 lbs.: and their absolute velocity, or $\text{v} = 5.30$ feet.

Therefore, by substituting these values in the first formula, we find the relative force F=205 lbs., which agrees very well with what we have just found above.

If instead of this first formula, the second be taken, it gives F = 153 lbs., which is far too little.

By this it is evident, that the last of Euler's two formulæ is to be preferred in all respects. Mr. Schulze made a great number of combinations, and almost always found the same effect.

Dividing the 205 lbs. which we have just found, by 7, the number of workmen, we get 29 lbs. for the relative force, with 2.45 feet relative velocity for each man, which is rather more than the values commonly adopted in the computation of machinery. A number of other observations on different machines, have given the same result; that is to say, we must value the mean human strength, at 29 or 30 lbs., with a velocity of 2½ feet per second.

To obtain the ratio of the strength of a horse to that of a man, Mr. Schulze proceeded in a similar manner; but his results, in reference to that inquiry, are neither so correct nor so interesting.

[TO BE CONTINUED.]

On the Bluing of Steel.

Iron and steel articles, when their surfaces are polished, whether simply by the file or from friction with emery, putty of tin, &c. are susceptible of receiving a blue colour from the action of heat; and which is rendered more beautiful, or deeper, in proportion as the surface is more perfectly polished, or the operation more carefully performed.

Every worker in iron and steel supposes himself to be capable of properly bluing the articles which he has made; but very few of them succeed well in it. There are some workmen, however, who, by great experience, excel in this branch, which may be considered as an art of itself. Clock and watch-spring manufacturers, and more particularly the makers of watch-springs, succeed very well; but the manufacturers of the steel hands for watches, have attained the highest point of perfection in it.

By means of heat, steel is made to receive a series of iris colours in the following order; viz. straw-colour, orange, red, pigeon's breast, violet, blue, and gray. Iron will receive the same colours, but is not susceptible of taking so vivid a tint as steel. When steel has been hardened, it must be tempered before it can be finished; and it must be softened more or less, according as it is necessary for the article to possess a greater or lesser degree of hardness in use. In some cases, it is not necessary to give an equal colour the whole length of the article, as the colour is frequently removed in the successive operations. It is nevertheless advantageous, however, that it should be as equal as possible, in order that the degree of hardness may be uniform throughout. It is a very different case when the articles are finished and well polished, and are intended to remain blue; such, for instance, as the hands of a clock or watch: as then, if the blue is not perfectly equal, and very deep, it presents a disagreeable appearance. The following method appears to us to be the most advantageous; and we have seen it practised by the workmen in Geneva, and other parts of Switzerland, who excel in this art; it has also been successfully employed by many workmen in Paris. In a kind of stove made of sheet iron, they place turfs made of tanners' bark, or merely tan-dust: these are covered with lighted charcoal-dust. The fire soon communicates to the turfs, or tan-dust: when these begin to burn, they place the pieces intended to be blued, upon them, taking care that the ashes do not cover them, in order that they may see the colour which they assume. It is requisite to be very careful that the heat be uniform, and that it be retained at exactly the same degree, without being too great; as, in that case the operation would fail entirely, and the blue colour soon disappear and turn to a gray; the article would lose its hardness, it must be hardened afresh, and there would be a very great chance of its being overheated. In order to avoid these inconveniences, we should prefer a fire less active, and operate by degrees. When the well-polished steel has acquired a red colour, and it is seen that this colour is not perfectly uniform, the greatest heat must be directed towards the part where the colour is less intense, by blowing with the mouth that part of the fire adjacent to it. By this means, and with great care and patience, a beautifully uniform and deep blue colour is obtained.

When the article has become of a red colour, if it is found to be clouded with various shades, it is better to suspend the operation, and polish the article afresh, either with emery, tripoli, crocus-martis, putty of tin, &c. and entirely to begin anew; rather than expose the article to too great softening. We can only here point out general rules; there exists in every art, a kind of dexterity, which practice alone can give.

When the article has acquired the desired colour, it is withdrawn from the fire, and allowed to cool slowly, when it must be wiped with a clean, dry, linen cloth. Particular care is required not to touch the articles when finished, with greasy, or damp fingers; but above all, not to dip them in oil, as they would become dull, and lose that lustre in which consists all their beauty. This blue colour remains for a long time: nevertheless it is subject to change; in which case, it may be restored to all its freshness, by being polished anew, and again submitted to the same operation.

Iron never takes so fine a blue as steel; as it does not receive so good a polish, neither is it so hard; and it is probable that the carbon contained in the steel, has some influence on this operation. L.

[*Dictionnaire Technologique.*

Observations on Sheep and Wool.

The "Bulletin des Sciences Agricoles," for July, 1827, contains a review of a German Work on Sheep and Wool, by J. C. Ribbe, published at Prague, Bohemia, from which we have translated the following, save what is enclosed in brackets.

The author adopts the opinion of Linnæus, that all the different kinds of sheep which exist are derived from a common stock, the *Ovis Argalis* [or the wild sheep which inhabit the rocky mountains of Asia and Greece.] The largest species of sheep in Europe is the breed of Flanders, which the Dutch imported from India, about two centuries ago. The smallest race is that of Scotland.—[M. Ribbe refers to the Hebridean sheep—a small breed, which weigh from 4 to 5 pounds per quarter, when fat, and yield about one pound of wool of various colours. These small animals frequently carry 4 or 5 horns. This breed was imported into Scotland from Denmark at a very early period. There is now a race in Denmark which have four horns.] The national sheep of Hungary have, in both sexes, strait horns, from 12 to 15 inches long. The wool is five or six inches in length, and so coarse, that it is fit for nothing but blankets.

Iceland has two sorts of sheep, one large, the other small. Their wool is brown, and the inhabitants do not shear it, but pull it off—a most cruel operation. The Icelanders make great use of sheep's milk. These animals live all the year exposed to the severity of the weather, and their principal food in winter is the moss called Iceland moss, which they obtain under the snow. The small species live among the steep rocks on the mountains, and sometimes a flock is carried over a precipice into a gulf, by an avalanche, where they remain until the warmth of their bodies melts the snow which covers them, and announces to their owners, by the steam which ascends, the place into which they have been carried.

In the Crimea, and some countries near the Caspian sea, they have sheep that bear, when young, short, curled wool, of a blue, brown, or black colour, which is an object of commerce. That the wool may remain in small curls, the Tartars cover the lambs with a linen cloth sewed close around them, which is not taken off until the animal is killed.—[These lambskins are celebrated, being damasked, as it were, by clothing the little animal.] In some of the vast forests of Russia there are sheep which live in a wild state; these animals are so much affected by the sounds of drums and trumpets that they begin to run, leap and dance, as soon as they hear them; and they continue these motions until, overcome by excitement and fatigue, they are no longer able to flee from their enemies.

[The largest breed of sheep in the world, is the fat tailed variety; it is raised in central Asia, China, Persia, Africa, &c. The tail is a mass of fat, and often weighs 30 pounds. Another variety of Asia, is the long tailed breed, with coarse wool; its tail sometimes drags on the ground.]

Europe did not possess any fine wooled sheep until the twelfth century. The Roman writers mention that fine wools and stuffs were imported from Spain, but this only proves that the Spanish sheep were better than those of the rest of Europe. In the twelfth century some African merchants sent to Cadiz a few sheep, the wool of which was remarkable for its fineness and whiteness. They were purchased by a Cadiz merchant, and placed on his country estate, where they succeeded, but he found no imitators.

About the year 1350, Peter, king of Castile, having been informed that there was a race of sheep in Barbary which had precious fleeces, sent several persons into Morocco to buy a great number of bucks. From this epoch commenced the reputation of the wool of Castile. In the 16th century, when Cardinal Ximenes was the Spanish minister, complaints were made to him that the sheep of Castile had deteriorated. To remedy the evil, this minister determined to import a great number from Barbary; but as he could not obtain them by means of negociation, he kindled a war, and invaded Morocco. The Spanish soldiers had orders to bring away as many sheep as they could; they pillaged the country, and returned to Spain with the precious plunder.

The principal breeds of Spain are those which the monks of the Escurial possess; those of the convents of Guadaloupe and of Paular; those of the duke d'Infantado, and of the counts of Negretti and Montarco. The sheep of the Escurial have the most beautiful wool, those of Guadaloupe are celebrated for their form and fleece; those of Paular have their head covered with wool, and their neck full of wrinkles; those of Infantado are born with coarse wool, which afterwards becomes very fine; and those of Negretti have a strong and robust body, with fine wool. All these races are called merinoes, and were formerly the travelling flocks of Spain; since the late wars, they have become stationary. All the fine races of sheep now in Europe were derived from the merinoes of Spain.
[*Hampshire Gazette.*

The Rumford Premium of the American Academy.

From the Boston Journal of Science, for 1824, we copy the account of the donation of Count Rumford, and the purposes of the gift. Upwards of thirty years have elapsed, yet the prize has never been awarded to any one, and the interest of the fund now amounts biennally, to upwards of two thousand dollars. Is the existence of the premium nearly unknown, or have thirty years passed, without any important discovery, or useful improvement having been made on heat or light, in the American continent, or islands? We really think, that were the Count now alive, he would be able to designate persons fully entitled to the reward. Editor.

In the year 1796, Count Rumford, then residing in London, presented to the American Academy of Arts and Sciences, five thousand dollars, in 3 per cent. stock, for the purpose of establishing a biennial premium to be awarded to the author of the most important discovery, or most useful improvement on heat or light, which should be made in any part of America. The following letter addressed to the President of the Academy accompanied the donation, and contains an account of the views of the liberal donor, and of the terms upon which the premium was to be awarded.

To the Hon. John Adams, President of the American Academy of Arts and Sciences.

Sir,—Desirous of contributing efficaciously to the advancement of a branch of science which has long employed my attention, and which appears to me to be of the highest importance to mankind; and wishing at the same time, to leave a lasting testimony of my respect for the American Academy of Arts and Sciences, I take the liberty to request that the Academy would do me the honour to accept of five thousand dollars, three per cent. stock, in the funds of the United States of North America, which stock I have actually purchased, and which I beg leave to transfer to the Fellows of the Academy, to the end that the interest of the same may be by them, and by their successors, received from time to time, for ever, and the amount of the same applied and given, once every second year, as a premium, to the author of the most important discovery, or useful improvement, which shall be made and published by printing, or in any way made known to the public, in any part of the continent of America, or in any of the American Islands, during the preceding two years, on heat, or on light; the preference always being given to such discoveries as shall, in the opinion of the Academy, tend most to promote the good of mankind.

With regard to the formalities to be observed by the Academy in their decisions upon the comparative merits of those discoveries, which, in the opinion of the Academy, may entitle their authors to be considered as competitors for this biennial premium, the Academy will be pleased to adopt such regulations, as they, in their wisdom, may judge to be proper and necessary. But in regard to the form, in which this premium is conferred, I take the liberty to request that it may always be given in two medals, struck in the same die, the one of gold, and the other of silver, and of such dimensions, that both of them together may be just equal in intrinsic value, to the amount of the interest of the aforesaid five thousand dollars stock, during two years; that is to say, that they may together be of the value of three hundred dollars.

The Academy will be pleased to order such device or inscription to be engraved on the die, they shall cause to be prepared for striking these medals, as they may judge proper.

If during any term of two years, reckoning from the last adjudication, or from the last period for the adjudication of this premium by the Academy, no new discovery or improvement should be made, in any part of America, relative to either of the subjects in question, (heat, or light,) which in the opinion of the Academy, shall be of sufficient importance to deserve this premium; in that case, it is my desire that the premium may not be given, but that the value of it may be reserved, and being laid out in the purchase of additional stock in the American funds, may be employed to augment the capital of this premium; and that the interest of the sums by which the capital may from time to time be so augmented, may regularly be given in money, with the two medals, and as an addition to the original premium, at each succeeding adjudication of it. And it is further my particular request, that those additions to the value of the premium, arising from its occasional non-adjudications, may be suffered to increase without limitation.

With the highest respect for the American Academy of Arts and Sciences, and the most earnest wishes for their success in their labours for the good of mankind,

I have the honour to be, with much esteem and regard, sir,

Your most obedient, humble servant,

RUMFORD.

London, July 12th, 1796.

Upon the receipt of the donation, the thanks of the Society were presented to Count Rumford in the following terms:

Voted, That the thanks of the Academy be presented to Count Rumford, for this his very generous donation, and that they experience the highest satisfaction in receiving this additional and very liberal aid, for the encouragement and extension of those interesting branches of science, which he has specified as the objects of his gratuity, and which *he* has so successfully cultivated: That they entertain a high sense of the sentiments and views, so becoming a philosopher, which have prompted him to this distinguished act of liberality; and in the execution of the grateful office, which they have undertaken, of awarding and distributing the premium which Count Rumford has thus appropriated, they will sacredly comply with the conditions of the donation; indulging the hope, that he will meet his reward, in learning that many in his native country are thereby excited to emulate his labours, and to promote the accomplishment of his beneficent wishes, for the advancement of science, and the augmentation of human happiness.

At a meeting held in May 1801, the Society voted, that they would, at their meeting in May of the next year, and afterwards, biennially at their May meeting, decide upon the discovery or improvement which appeared to deserve the Rumford premium. The subject, we believe, has frequently been brought before the Society, and they have been ready at the appointed time, to confer the premium upon any individual, whose claims were sufficient to authorize it. No discovery, however, or improvement, has yet been made, which has been deemed worthy this honour, and the fund has of course been accumulating, according to the terms of the donation, ever since it has been in the hands of the Society.

At the present time, the fund amounts to $7361 19, in 6 per cent., and $7050 in 7 per cent. stocks. The premium awarded, would, therefore, be the interest of these sums for two years; three hundred dollars in the form of a silver and a gold medal, and the residue in money. This we believe is one of the largest premiums offered by any society or institution, for discoveries in science, or improvements in the arts, and is well worthy the attention of the scientific and ingenious men of our country.

The next meeting of the Society, will be held on Tuesday the 25th of May next, at their room in the Boston Atheneum. At this meeting the Society will be ready to decide upon any claims which may be offered, for the premium in question; it being the regular biennial period, at which, by their vote of 1801, this subject comes before them.

Instances of Longevity in Modern times.

That instances of longevity are not so rare in modern times as is usually imagined, the subjoined list, collected from various sources, is a curious proof, to which I beg you may give a place, if you think it will afford any amusement to your numerous readers. That I might not swell it to an inconvenient length, none have been inserted who have not attained the 130th year, or whose longevity has not appeared to be well attested. Many more might, without doubt, be added, by those who have better opportunities for collecting such accounts. The date affixed to each name is the year in which each person died, when that has been ascertained; or when not, the latest year in which each is known to have lived.

Year.		Age.	Year.		Age.
1795	David Cameron	130	1772	Mrs. Clum	138
1766	John de la Somel	130	1766	Thomas Dobson	139
1766	George King	130	1785	Mary Cameron	139
1767	John Taylor	130	1752	William Laland	140
1774	William Beatie	130	——	Countess Desmond	140
1778	John Watson	130	1770	James Sands	140
1780	Robert Macbride	130	1773	Swarling, a monk	142
1780	William Ellis	130	1773	Charles M'Findlay	143
1764	Elizabeth Taylor	131	1757	John Effingham	144
1775	Peter Garden	131	1782	Evan Williams	145
1761	Eliz. Merchant	133	1766	Thomas Winsloe	146
1772	Mrs. Keith	134	1772	J. C. Drahakenberg	146
1767	Francis Agne	134	1652	William Mead	148
1777	John Brookey	134	1768	Francis Consir	150
1744	Jane Harrison	135	1542	Thomas Newman	152
1759	James Sheile	136	1635	Thomas Parr	152
1768	Catherine Noon	136	1656	James Bowles	152
1771	Margaret Forster	136	——	Henry West	162
1776	John Moriat	136	1648	Thomas Damme	154
1772	—— Richardson	137	1762	A Polish peasant	157
1793	—— Robertson	137	1797	Joseph Surrington	160
1757	Wm. Sharpley	138	1668	Wm. Edwards	168
1768	John M'Donough	138	1670	Henry Jenkins	169
1770	—— Fairbrother	138	1782	Louisa Truxo	175

To these may be added, a Mulatto man, who died in 1797, in Frederick Town, North America, and who was said to be 180 years old.

In *The County Chronicle*, of December 13, 1791, a paragraph was inserted, which stated, that Thomas Carn, according to the parish register of St. Leonard, Shoreditch, died the 28th of January, 1588, aged 207; but this is an instance of longevity, so far exceeding any other on record, that one is disposed to suspect some mistake either in the register or in the extract.

AMERICAN PATENTS.

List of Patents granted in the United States, from June 1st, to August 22nd, 1827.

FOR INVENTIONS AND IMPROVEMENTS.

Improvement in riding, wheel, carriages; William and Josiah Jessop, Guilford County, N. C., June 1.

In the construction of cast-iron foot-stoves; George W. Robinson, New York, June 2.

In the saw mill; Anthony Bencine, Milton, Caswell County, N. C., June 4.

In the machine for nets to pine-apple cheese; Lewis Mills Norton, Litchfield. Conn., June 4.

In the grist mill for grinding grain, with the periphery of the stone; Robert S. Thomas, of Rockingham, Richmond County, N. C., June 4.

In the cotton or hay press; Thomas D. Wilson, Corydon, Harrison County, Indiana, June 6.

In the water-wheel; Thomas D. Wilson, Corydon, Harrison County, Indiana, June 7.

In the machine for churning butter; Nathan Whitney, Augusta, Maine, June 7.

In the mode of letting the water on water-wheels; Jacob Ammon of Rockingham County, Virginia, June 8.

In constructing culinary fixtures for anthracite coal; Jacob F. Walter, Philadelphia, June 8.

In an apparatus for spinning wool and cotton, &c.; William Church, Birmingham, England, June 11.

In the bellows; Jesse Dixon, Pittsborough, Chatham County, N C., June 11.

In the grist mill, patented by Moses Mendenhall, October 20, 1826; Samuel Lawing and James Monteith, Statesville, Iredell County, N. C., June 11.

In a machine for preparing mortar. and grinding apples for cider, &c.; Thomas Streeter and James Wibirt, of Chili, Monroe, New York, June 12.

In the machine for boring earth; John R. Failing, Canajoharie, Montgomery County, New York, June 13.

In stills; Malcolm M'Gregor, of New York, June 15.

In the steam engine; John Maynard, of Ovid, New York, June 15.

In the grist mill; William W. Forwood, of Hartford County, Md. June 15.

In the mill for grinding corn and other grain, called the sugarloaf mill; Sidney Moore and Portius Moore, of Mount Irzah, Person County, N. C., June 15.

In the discovery of a certain composition of matter, whereby scagliola is rendered more shining, vivid, and beautiful; Salvadore Pinistri, of New York, June 18.

In the cork cutter; Luther Hills, of Boston, June 18.

In the boot crimping, or boot blocking machine; Samuel Morehouse, of Eastport, Maine, June 19.

In the engine for dividing scales, gauges, rules, &c.; Samuel Hedge, of Windsor, Vermont, June 20.

In suspenders; Edwin Chesterman, of New York, June 19.

In the grist mill, for grinding grain of any kind; William A. Turner, of Plymouth, Washington County, N. C., June 27.

In the machine for dicing, and polishing, or rolling morocco leather; Samuel Couillard, jr., of Boston, Massachusetts, June 27.

In the machine for sawing shingles out of planks, &c.; Nathan Swift, of Lebanon, Conn., June 27.

In the washing machine; David Beard, of Buffaloe, New York, June 27.

In the plough; William Beach, of Philadelphia, June 27.

In the machine for hewing and hammering stone; Charles B. Reed, of West Bridgewater, Plymouth County, Massachusetts, June 27.

In the machine for spinning wool; Benjamin Lapham, of Queensburg, Warren County, New York, June 29.

Improvement in the horse harness, called a horse yoke; Adolphus Allen, of Troy, New York, June 29.

In preventing friction on spindles, called serve wheels; Johann Gottleib Sholze, Pickaway Township, Ohio, July 6.

In the percussion gun-lock; Marvel C. Davis, of Mayville, Chataugue County, New York, July 10.

In a mortising machine; Simon Leroy, of Mexico, Union Square, Oswego County, New York, July 10.

In manufacturing steam and rotary wheel engines; Francis Harris, of Albany, New York, July 10.

In the mode of manufacturing wool or other fibrous material; John Goulding, of Dedham, Norfolk County, Massachusetts, July 10.

In the machine for roping and spinning wool and cotton by hand, called "Brown's vertical spinner;" Henry Wilson, of Pomfret, Chataugue County, New York, July 13.

In the means of transporting a boat, or other body, from one canal level to another; Robert P. Bell, of New York, July 13.

In cements for roofs, or walls of buildings, &c.; Charles Clinton, of New York, July 13.

In the screw auger; Judson Smith, of Derby, New Haven County, Conn., July 13.

In the hand printing press; Samuel Couillard, of Boston, July 14.

In the machine for bending tire of carriage and other wheels, metallic bands, and hoops, &c.; Walter James, of Ashford, Windham County, Conn., July 14.

Improvement called Cooper's rotative piston; John M. Cooper, of Guildhall, Essex County, Vermont, July 16.

In the mode of conveying or hauling earth, stone or other substances, from the bottom of canals, or other cuttings in the earth, by machinery; Oliver Philips, of Lansing, Tompkins County, New York, July 16.

In the grist mill; Washington Adams, Guilford County, N. C., July 18.

In fermenting and distilling spirits; Ira Belnap, Millersburg, Dauphin County, Pennsylvania, July 20.

In the manufacture of gas-lights from cotton seed; Denison Olmsted, New Haven, Conn., July 21.

In the portable crane, for raising brick, stone, mortar, timber goods, &c. Ezekiel Mann, and George Hill, of Rochester, Monroe County, New York, July 21.

In the grist mill; Avery Coe, and John Coe, of Guilford County, N. C., July 21.

In the bush for a mill-stone; Nathan Taylor, Urbana, Steuben County, New York, July 23.

In the mode of making cordage, by machinery; Robert Graves, Brooklyn, New York, July 25.

In the mode of passing canal boats, up and down elevations, by machinery; Robert Graves, Brooklyn, New York, July 26.

In the machine for making Cooper's staves, ready for the tress-hoop; Amory Amsden, Bloomfield, Ontario County, New York, July 27.

In the machine for spinning wool and cotton, called the family spinner; William W. Jones, Thornville, Perry County, Ohio, July 27.

In the construction of rail-way carriages; Richard P. Morgan, Stockbridge, Massachusetts, July 27.

In the machine for cutting straw; Laban Durham, and John S. Pleasants, of Halifax County, Virginia, July 27.

In the machine for cutting wheat, oats, &c. by horse power; Laban Durham, and John S. Pleasants, of Halifax County, Virginia, July 28.

In a machine called an up and down revolving water wheel, for raising water; Henry Miller, of Allentown, Northampton, Pennsylvania, July 28.

In the cast-iron horse hoe, for ploughing and weeding grains and herbs, planted in hills, and rows; William Carmichael, Land Lake, Renssalaer County, New York, July 28.

In the machine for warning, or notifying the drivers of carriages, called the coach alarm; Walter Hunt, of New York. July 30.

In the manufacture of hollow wooden ware; Elisha Briggs, of Perry, Gennessee County, New York, July 30.

In the method of cooling water, or other fluids, William Thornton, of Washington City, D. C., July 31.

In a machine called Schreiner's chimney smoke, and safety valve; Joseph H. Schreiner, of Philadelphia, Pennsylvania, July 31.

In the mode of moving brick, stone, or wooden buildings, with the chimneys, furniture, and families therein; Simeon Brown, of New York, July 31.

In the harrow and plough hoe, or a new method of attaching hoes of different descriptions, to the helve of the harrow and plough, for cultivating corn, wheat, rye, oats, cotton, tobacco, &c.; Isham Cheatham, of Providence, Chesterfield County, Virginia, July 31.

In the machine for cutting card teeth; Joshua Lamb, of Leicester, Massachusetts, August 1.

In the tide mill; Robert Spedden, of Talbot County, Md., August 1.

In the machine for dressing, drilling, and working granite, and other kinds of stone; Hermon Bourne, of Salem, Essex County, Massachusetts, August 3.

In a machine called the sack shoulderer; Lewis Rice, of Clarksboro, Gloucester County, New Jersey, August 3.

In the machine called the economical victualler, being an improvement on the peripurist; Benjamin C. Burdett, of New York, August 4.

In the mode of tightening bed sackings, called the improved detached screw bed sacking; John K. Simpson, Boston, Massachusetts, August 10.

In the machine for separating the seed from cotton, called the Sea Island cotton cleanser; Jesse Reed, of Marshfield, Plymouth County, Massachusetts, August 10.

In the thrashing, winnowing, and flax breaking machine; Edmund Warren, New York, August 10.

In a machine for removing stumps, and other heavy and fixed bodies; Abijah Pratt, of Jackson, Washington County, New York, August 17.

In the steam engine; Warren P. Wing, of Greenwich Village, Hampshire County, Massachusetts, August 17.

In the machine for separating, or thrashing grain from the straw, and for breaking flax, and hemp; Peter Barker, of Worthington, Franklin, Ohio, August 20.

In the plough, called the right and left plough; George Dofler, Fredericktown, Md., August 20.

In the method of determining the proof and strength of distilled, or alcoholic spirit; William Cornell, Brooklyn, New York, August 20.

In the water wheel, for saw and grist mills; James Deniston, of Lanier Township, Preble County, Ohio, August 22.

In the construction of a sofa and bedstead united, which may be used for either purpose; John R. Penniman, Boston, Massachusetts, August 22.

In the gearing of cones, for bowing hats; Trueman F. Mayhew, Boston, Massachusetts, August 22.

ENGLISH PATENTS.

List of patents for New Inventions, which passed the Great Seal, in England, from July 25th, to September 6th, 1827.

To Edward Dodd, musical instrument maker, for his invention of certain improvements on piano-fortes—25th July.

To Thomas Peck, engineer, for his invention of the construction of a new engine, worked by steam, which he intends to denominate a revolving steam engine—1st August.

To William Parkinson, gentleman, and Samuel Crosley, gas apparatus manufacturer, for their having found out an improved method of constructing and working an engine, for producing power and motion—1st August.

To Joseph Maudsley, engineer, for his invention of certain improvements on steam engines—1st August.

To Lionel Lukin, esq., in consequence of communications made to him by foreigners abroad, and discoveries made by himself, for certain improvements in the manufacture of collars, for draught and carriage horses, and saddles, for draught, carriage, and saddle horses—1st August.

To Eugine du Mesnil, esq., for his invention of an improvement, or improvements on, or additions to, stringed musical instruments—1st August.

To Anthony Scott, earthenware manufacturer, for his invention of an apparatus, for preventing the boilers of steam engines, and other similar vessels of capacity becoming foul, and for cleaning such vessels, when they become foul—4th August.

To Peter Burt, mathematical instrument maker, in consequence of a communication made to him by a certain foreigner residing abroad, for an invention of an improved steam engine—4th August.

To John Underhill, for his invention of certain improvements in machinery, or apparatus for passing boats and other floating bodies, from a higher to a lower, or a lower to a higher level, with little or no loss of water, and which improvements are also applicable to the raising or lowering of weights on land—13th August.

To Robert Dickinson, tin plate merchant, for his invention of an improved buoyant bed or mattrass—13th August.

To Thomas Breidenback, merchant, for his invention of certain improvements on bedsteads, and in making, manufacturing, or forming articles, to be applied to, or used in various ways with bedsteads, from a material, or materials, hitherto unused for such purposes—13th August.

To William Alexis Jarrin, Italian confectioner, for his invention of certain improvements in apparatus for cooling liquids—13th August.

To William Chapman, civil engineer, for his invention of a certain improvement or improvements, in the construction of wagons that have to travel on rail-ways or tram-ways—14th August.

To Henry Pinkus, of Philadelphia, in the state of Pennsylvania, in the United States of North America, but now resident at the Quadrant Hotel, Regent street, in the county of Middlesex, gentleman, for his having invented, or found out, an improved method or apparatus for generating gas, to be applied to lights and other purposes—15th August.

To William Spong, gentleman, for an invention for diminishing friction in wheel carriages, water wheels, and other rotatory parts of machinery—15th August.

To Lemuel Wellman Wright, engineer, for his having invented or found out, certain improvements in the construction of cranes—17th August.

To Lemuel Wellman Wright, engineer, for his having invented or found out, certain improvements in machinery for cutting tobacco—21st August.

To Gabriel de Soras, gentleman; and Stacey Wise, and Charles Wise, paper-makers, in consequence of a communication made to them by a certain foreigner resident abroad, for an invention of certain improvements in sizing, glazing, or beautifying, the materials employed in the manufacturing of paper, pasteboard, Bristol boards, and other substances—21st August.

To John Hague, engineer, for his invention of a new method of working cranes, or tilt hammers—30th August.

To Benjamin Merriman Combs, ironmonger, for his invention of certain improvements, or additions to a pulley machinery, and apparatus, used and applied for securing, fixing, and moving, curtains, and roller, and other blinds—30th August.

To William Debtmer, piano-forte maker, for his invention of certain improvements on piano-fortes—30th August.

To William John Ford, farrier, for his invention of certain improvements in the make, use, and application, of bridle bits—6th September.

To George Clymer, engineer, for his invention of an improvement in typographic printing, between plain or flat surfaces—6th September.

FRENCH PATENTS.

List of Patents granted by the French Government, from the first of April, to the 30th of June, 1827.

To Messrs. Barthelemi Galimer, Son, of Cannes, distiller, and Michel Espinas, of Beziers, coffee house keeper, for a moveable apparatus for distilling wines, and other liquors—10 years.

Messrs. Dollfus, Mieg and Co., of Mulhausen, oil cloth manufacturers, for a machine for printing several colours and shades upon stuffs at the same time—5 years.

Louis Joseph Pouiltot, and Daughter, pewter manufacturers, of Paris, for a pencil case with ink-horn, brass pens, and sand box—5 years.

M. Ancelle, shoemaker, Paris, for an elastic clog—5 years.

Messrs. de Renneville, and Lemoine Desmares, for a new method of bleaching and washing wool—10 years.

Jean Louis Boucarut, painter and gilder, Paris, for improvements in pannel painting—10 years.

Messrs. Koechlin, and Zimmermann, builders, of Kaisersberg, for a stretching board for cotton spinning—5 years.

Messrs. Favreau, Paris, for an instrument which may be used as a pencil case and inkstand, by means of a small forcing pump—5 years.

M. Havard, pump manufacturer, Paris, for an apparatus adapted to the seats of water closets—10 years.

Louis Roth, Paris, for a new method of distilling, with other improvements—10 years.

Zavier Andoyer, writing master, Paris, for the invention of a new system of writing, called the American, or the art of learning to write in a few lessons—5 years.

Mathurim Cosson, billiard table maker, for new invented pockets for billiard tables—5 years.

Messrs. Alexis Orry, Honore Nery, and Claude Simon de Cormeille, engineers, Paris, for an apparatus, called a fumi-comburateur, for consuming smoke and its noxious particles—10 years.

Jean Baptiste Thomas Jamain, of Charleville, tinman, for a pump with four valves, for raising water from the deepest well to the upper stories of houses—5 years.

Joseph Claude Heyraud, Paris, for a method of making horse shoes with a die—10 years.

Louis Joseph Etienne Cordier, Paris, for improvements in floodgates and sluices—10 years.

Francois Pierre Lebourlier, Paris, for a method of stripping the rind, and whitening black pepper—5 years.

Isaac Sargent, and Thomas Hodgkin, Paris, for improvements in baking bricks, tiles, slabs, and earthenware—15 years.

Armand Lemonnier, mechanic, Chatillon sur Seine, and Joseph Maitre, of Villotte, for a machine for making the tires of wheels—10 years.

Jean Pierre Caplain, mechanic, and Deve Lemaitre, of Elbeuf, for a machine for making pins' heads in general—5 years.

Edward Church, American Consul, at Lorent, for a gandole to sail by steam—5 years.

Jacques Francois Etienne Onarmier, Paris, for a high pressure filtering stone—10 years.

M. Guelle, tinman, Paris, for improvements in making sky-lights, window frames and glazing, called the finestra—5 years.

M. Hulot, calico maker, St. Arnould, for a stuff for making collars and stocks—5 years.

Louis Ladaviere, Jeweller, Lyons, for a machine called semequelle, for marking the points at cards and other games—10 years.

Moisson Devaux, Paris, Banker, for an apparatus for making metallic tubes by pressure—10 years.

Stanislas Sorel, of Ecouche, and Louis Francois Prudent Artus, of Alencon, clockmaker; for a pyrometre, for measuring the higher temperatures—5 years.

M. Bantam, jeweller, of Paris, for a double pair of spectacles called the binocle a tirage simultanee—5 years.

Hilaire Bellomet Warin, ironmonger, of Remilly, for improvements in spindles, &c.—5 years.

Dr. Allevy, Paris, for a machine called the hydro ponderique, for raising weights—15 years.

Charles Frederick Gagnoux and Co. silk manufacturers, Lyons, for a loom for making net work with square meshes—15 years.

Parfait Modeste Carpentier, Paris, for a mechanical bed, and arm chair, with springs, for the use of sick people—15 years.

Henry Pottet Delcusse, gunsmith, Paris, for a gun which may be loaded by the stock or breech—5 years.

Theodore Jones, London, for improvements in the wheels of carriages, &c.—15 years.

Pierre Fasanini, Lyons, for a machine for weaving, so constructed that when the woof or warp breaks, the machine stops—10 years.

Louis Bassnet, perfumer, Bordeaux, for a powder and lotion, for preserving the teeth and mouth, called the poudre and liqueur vegetales—5 years.

Jean Baptiste Fournier, Paris, for improvements in the pockets of billiard tables—5 years.

Pierre Victor Becasse, Paris, for improvements in the spokes of wheels—5 years.

[TO BE CONTINUED.]

NOTICES.

To Correspondents.—The completion of the article on extracting the Fecula from the Potato, is delayed in consequence of the unfinished state of the engravings.

Kiln for drying Indian Corn.—A subscriber will be obliged, by information on an economical mode of constructing a kiln, for the above purpose. We intend to prepare an article on this subject, and hope that some person who has had experience, will enable us to give to it all the practical value of which it is susceptible.

Errata.—In consequence of changing a word, without making a corresponding change in the other members of the sentence, a small part of the impression of the present number, requires the following corrections:

Page 90, line 7th from the bottom, for '*it professes,*' read, they profess.
Do. „ 6th „ „ for '*supposing it,*' read, supposing them.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS,

Internal Improvements, and General Science.

MARCH, 1828.

Description of the manner of Polishing and Silvering Plates for Looking Glasses, as practised in Paris.

[From the Journal Polytechnique.]

These plates of glass are cast at St. Gobin, because the materials of which they are composed, and the fuel necessary for melting them, are more conveniently procured there than at Paris. But, as it is necessary that a large quantity of these glasses should be kept at Paris, that being the place where there is the greatest demand, even for those which are intended for exportation into other countries, they are brought there in the rough. In that state, being more thick, they are less subject to be broken; and the inconvenience which would arise from their being scratched, or having the silver rubbed off, is also thereby avoided. If only a few were broken after being finished, (particularly if they were of a large size,) the loss would be more considerable than that occasioned by the breaking of a much greater number in their rough state; it being very difficult to finish them in a perfect manner, and keep them, at the same time, of their full size: those which are obtained in that state bear a very high price. Besides, in the magazine at Paris, to avoid unnecessary expense, they polish and silver only those plates for which orders are given.

For the reasons above mentioned, the plates are brought, in a rough state, from St. Gobin to Paris, both by land and water; and, to guard against accidents, they are placed on end, in a kind of wooden frame, leaning one against the other, and kept in at the bottom by a ridge, which admits within it the thickness of the plate.

These frames are suspended, by very elastic springs, on carriages, which are also hung upon springs. Between the plates are put, at certain distances, slips of elastic cloth, which prevent them from striking against each other.

When the glasses have been cast and annealed, (that is, cooled gradually,) they are pretty smooth (but by no means sufficiently so) on that side which lay against the plate of metal on which they were cast; on the other side they are rough and undulated: both surfaces are to be ground perfectly even. Before that operation is begun, they are examined, to see whether they have not some defects, such as deep cavities, or cracks, which might hinder their being polished in their original size. If any such defects are found, they are cut, by means of a diamond, in such a manner as to keep the plates as large as possible. If the line made by the diamond is near the edge of the plate, the part to be taken off is separated by blows with a hammer: if it is in the middle, the weight of the glass, acting as a lever, is sufficient for the purpose. If the glass was not what the workmen call well annealed,* it would not bear to be cut; but, when it is well annealed, it is more flexible, and less brittle, than is commonly supposed. This is proved, not only by the operation just spoken of, but also by the following experiment of M. Buffon. He had a plate of glass fixed in a frame; over the middle of the plate was a screw, the end of which was covered with leather: by turning the screw, so as to press against the middle of the plate, he could produce therein a very evident degree of curvature.

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* As the operation of annealing is very important, and the term itself improper, because it leads to false ideas of that operation, I shall here give some account of it. Annealing consists in cooling a body, which is dilated by heat, in a slow and progressive manner. To anneal plates of glass, they are put, immediately after being cast, and while yet soft, (upon the metal plate on which they were cast,) into a very hot oven, from which all flame and smoke are excluded, as they might tend to injure the colour of the glass. The fire is suffered to burn out gradually, and the plates grow cool, by degrees, as the fire abates. By this means, the contraction of the glass takes place very slowly, and equally in all directions. The particles of the glass approach nearer each other, and adhere together more strongly. If, on the contrary, the glass is suffered to cool in the open air, the following is the result. The glass, in melting, had increased in bulk; its surface, by being the first part cooled, and rather suddenly, preserves nearly the same dimensions. The internal particles, as soon as the heat which kept them at a distance from each other is entirely dissipated, are inclosed within a larger space, and consequently remain farther asunder: there is therefore a vacuum between these particles, and they tend to approach each other, both by their mutual attraction, and the pressure of the external air. For which reason, if this double effort is very strong, the glass splits, and breaks of itself; or, if the surface of the glass should be able to resist the effort, a very slight blow, or (what is more effectual) a trifling scratch upon its surface, is sufficient to break it. The first effect takes place when red-hot glass is dipped in water, or has water poured upon it. The drops of glass, called Dutch Tears, or Prince Rupert's Drops, furnish an example of the second kind. These drops are made by letting melted glass fall into water; as their surface is but small, and is of a spherical form, it is sufficiently strong to resist the expansion of the internal particles, and the pressure of the external air, caused by the vacuum which is formed within; but, if the end of the drop is broken off, the resistance ceases, and the glass drop, although very thick, is reduced into powder.

In some glass-houses, the workmen show glasses which have been cooled in the open air: on these they let leaden bullets fall, without breaking them. They afterwards desire you to let a few grains of sand fall on them; by doing which the glass is broken into a thousand pieces. The reason of this is, that the lead does not scratch the surface of the glass; whereas the sand, being sharp and angular, scratches it sufficiently to produce the effect here spoken of.

First Operation.—When the plates have been examined, in the manner already described, the first operation is, to make them thinner. For this purpose, one, or more, is placed upon a very even table of stone, or of thick wood: on this they are fixed, in a truly horizontal position, by means of a layer of plaster in a rather liquid state. A workman gets upon the glass, and treads it, so as to force the plaster to spread itself evenly under the glass. Other plates, eighteen inches or two feet square, and also in the rough, are fixed, by means of plaster, upon flat pieces of wood or stone, of the same dimensions as the plates themselves: taking care (in order that the friction may not be too great) to place the smoothest side outwards, if the roughest side of the other plate is to be first polished, and *vice versa.* When the plaster is dry, these small plates are put upon the others; and, upon the flat stone, or piece of wood to which they are fixed, is laid another stone, for the purpose of increasing the pressure. This last stone is let into a frame of wood, which has a kind of handle at each corner: it may be made fast to the other by the help of a little plaster. Between the glasses is thrown water, mixed with sand, or with powdered grit stone, which should be finer as the work advances. The workman, by moving the machine about by means of the handles, (which he passes from one hand to the other,) grinds the plates, by rubbing them against each other, so that those which serve to polish the others become also polished themselves; but being much smaller in size than the under ones, they are much sooner ground smooth, and therefore require to be changed from time to time. At the beginning of the operation, as the surfaces are very irregular, the plates would be in danger of being broken by too great a degree of friction, if the machine were too much loaded; but, as the surfaces become more smooth, other flat stones, an inch and a half, or two inches thick, are put between those we have already described. The friction is of itself sufficient to keep them together; they may, however, have pieces of cloth between them. A kind of ruler, laid on the plates, serves to discover what parts are most prominent, and require rubbing down.

The operation here described is a partial one, and is performed, successively, in different parts of the plate, merely for the purpose of rendering it smooth: it must afterwards be made even.

Second Operation.—Two workmen, one at each end of the table, drive the machine from one to the other, making it turn about, upon the plate, in all directions. As the work advances, machines of the same form, but larger in size, are employed. The polishing of the plates might be entirely finished by means of these machines; but the one we are now going to describe answers the purpose much more completely.

Third Operation.—When the second operation (which lasts two or three days) is finished, the workmen (by means of plaster) fasten upon a kind of table (of the same size as the fixed one) a plate of glass, as large as that which is to be polished, and which has already been ground to the same degree of smoothness. This plate is laid upon the other, and to the wooden back or table is fixed a large and very light wheel, formed of a piece of thin wood bent into a circular form, and having a certain number of thin spokes, to which the rim is nailed. Between the wooden table and the wheel, square pieces of thin stone are gradually added, in order to increase the weight, as the glass becomes polished. Two workmen, by means of this wheel, push the table backwards and forwards, and cause it to turn about in all directions, taking care that water, with sand in it, is often thrown between the plates.* By this means, the two plates at last acquire a perfectly even surface. When they have thus been ground on both sides, in such a manner that the surfaces are exactly parallel to each other, (which is discovered by means of rulers and proper levels,) they are not yet transparent, but have a whitish dull appearance on the surface, occasioned by an infinite number of little scratches made by the sand. They must still undergo other operations, which we shall now describe.

[TO BE CONCLUDED IN OUR NEXT.]

An account of the several Compositions of Metals and semi-Metals, on which trials were made, to find out the most proper mixture for the Specula of Reflecting Telescopes. By the Rev. JOHN EDWARDS, B. A.

[Forming the appendix to his paper upon Speculums.]

CONCLUDED FROM PAGE 80.

THE immense labour performed by Mr. Edwards in order to ascertain the best mixture for speculums, will appear from the results here given; these, however, form only a part of his experiments, the whole number of trials exceeding one hundred; but the compound No. 47, was far superior to either of the others. Although the greater number of the mixtures were found to be useless, the publication of them is not thought so, as it will prevent the performance of fruitless experiments by others.

After the publication of the directions already given, Mr. Edwards, in a letter to Dr. Maskelyne, gives the following additional precautions:—

"Make the brilliant composition first of copper and tin. Melt the proportional quantity of silver and brass in a small crucible by itself. When you put the brilliant composition the second time into the crucible, add also the lump of brass and silver melted together before in a separate crucible; and when the whole is now fluid, add the proportional quantity of arsenic, and then pour it off into the flasks, after the scoria is taken off, and a little powdered rosin is thrown into it."

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* We have observed, at those parts where the sand with which the glass is polished falls, very considerable efflorescences; they had the appearance and the taste of barilla. We believe that the glass (which is composed of barilla and sand) is decomposed, by the extreme division of its parts, and the heat occasioned by the friction made use of.

1. Copper and grain-tin, equal parts; very bad, soft, and of a blue colour.
2. Copper with arsenic $\frac{1}{8}$; but little different from the first.
3. Tin 2, copper 1; much worse than the preceding ones.
4. Copper 32, tin 16, arsenic 4, fixed with nitre; black and brittle.
5. Copper 6, tin $1\frac{3}{4}$, arsenic 1; very indifferent.
6. Copper 32, tin 14, arsenic 2; a very good metal.
7. Copper 32, tin $13\frac{1}{2}$, arsenic 1; not quite so good as the sixth.
8. Copper 32, tin $13\frac{1}{2}$, arsenic $1\frac{1}{2}$; a good metal.
9. Copper 32, tin 15, arsenic 2; much better than any of the above.
10. Copper 6, tin 2, arsenic 1; compact, but very yellow when polished.
11. Copper 3, tin $1\frac{1}{4}$; compact, and whiter than the tenth.
12. Copper 32, tin $14\frac{1}{2}$; a pretty good metal, but polishes too yellow.
13. Copper 32, tin 15, arsenic 2, flint glass, in powder, 3; very bright, but rotten.
14. Brass 6, tin 1; compact, but too yellow.
15. Two parts of the eleventh composition, and one part of the fourteenth composition; compact, but much too yellow when polished.
16. Brass 5, tin 1; somewhat whiter than the fourteenth.
17. Brass 4, tin 1; a good metal, but rather yellow.
18. Brass 4, tin 1, with arsenic $\frac{1}{10}$; whiter than the seventeenth.
19. Brass 3, tin 1; will not polish well.
20. Brass 2, tin 1; of a sparry nature.
21. Tin 3, brass 1; too soft, being only a kind of hard pewter.
22. Brass and arsenic, equal parts; a dirty white colour.
23. Brass, copper and arsenic, equal parts; a dingy white.
24. Brass and platina, equal parts; very difficult to fuse and mix well together, is then malleable, and of a dingy white colour, like the twenty-second composition.
25. Copper 32, tin 14, crude antimony 4; black and rotten.
26. Copper 32, tin 14, crude antimony 1; bluish, and rough-grained.
27. Copper 32, tin 15, arsenic 4, bismuth 2; much too rotten.
28. Copper 32, tin 15, arsenic 3, bismuth 1; much too yellow when polished, and appears also porous.
29. Copper 2, zinc 1; a pale malleable metal.
30. Copper and zinc, equal parts; still malleable and rough-grained.
31. Copper 32, tin 15, arsenic 4, zinc 4; a good metal, but does not take a high lustre.

32. The thirty-first composition fluxed with corrosive sublimate; a compact and hard metal, but rather yellow when polished.

33. Copper 32, tin 16; a most beautiful brilliant composition, but much too brittle and rotten.

34. Copper 32, tin 17; bluish and rough-grained.

35. Copper 32, tin 18; bluish and rough-grained.

36. Brass 2, zinc 1; nearly of a gold colour.

37. Brass and zinc, equal parts; a pale gold colour, and rough-grained.

38. Spelter 4, tin 1; very rotten.

39. Copper and crude antimony, equal parts; of a sparry nature.

40. Copper 32, tin 15, arsenic $\frac{1}{4}$th of the whole; a very beautiful and brilliant metal, but tarnishes when exposed for some time to the air.

41. Silver and bismuth, equal parts; a yellowish-white metal, and not much harder than silver itself.

42. Silver and tin, equal parts; a white metal, almost like silver itself, and much too soft for specula.

43. Silver, tin, and bismuth, equal parts; a dingy white colour, but much harder than the two preceding compositions.

44. Copper 32, tin 15, silver 1; a beautiful compact metal, but polishes rather too yellow.

45. Copper 32, tin 15, silver 2; not so white as the preceding.

46. Copper 32, tin 16, brass 4, arsenic 2; rather too much tin, as the composition was of a bluish complexion, and rough-grained.

47. Copper 32, tin 15, brass 1, silver 1, arsenic 1; a most excellent metal, being by much the whitest, hardest, and the most reflective I have ever yet met with.

48. Common bell-metal; polishes very yellow.

49. Common bell-metal 4, regulus of antimony 1; bluish and rough-grained.

50. Common bell-metal 6, regulus of antimony 1; still bluish and rough-grained.

51. Copper 32, tin 14, regulus of antimony $1\frac{1}{6}$, *viz.* 1 oz. to 1 lb.; too much antimony, it being of a bluish colour, and rough-grained.

52. Copper 32, tin 13, regulus of antimony $\frac{1}{16}$; bluish and rough.

53. Copper 32, tin 13, regulus of antimony $\frac{1}{32}$, *viz.* 1 oz. to 2 lbs.; a very fine metal, in appearance like thirty-three.

54. Copper 32, tin 13, regulus of antimony $\frac{1}{40}$, *viz.* 1 oz. to $2\frac{1}{2}$ lbs.; a beautiful metal, not much unlike forty-seven, but not quite so white.

55. Crude antimony 16, cawk-stone 1 or 2 oz.; a very bright glassy metal, like the common vitrum antimonii, but by no means fit for mirrors.

56. Copper 32, tin 16, vitrum antimonii, made from the cawk-stone 1 oz.; a very indifferent composition, as the vitrum antimonii did not differ in its effects from crude antimony.

57. Copper 32, tin 14, lead 2; no art can make this composition mix intimately, as the lead will always separate from the copper and tin.

58. Copper 32, tin 16, regulus of antimony 3; black, and much too rotten.

59. Copper 32, tin 16, iron-filings 8; a bluish-gray colour, and rough-grained, and appeared somewhat like steel when broken through.

60. Fifty-ninth composition 8 oz., tin 1 oz.; a little whiter than the fifty-ninth, but still too blue.

61. Equal parts of fifty-nine and sixty; still of too blue a colour, and not close-grained.

62. Copper 32, tin 16, arsenic 3, iron-filings $\frac{1}{4}$ of an oz.; a pretty brilliant composition, but much inferior to forty-seven.

63. Platina 1 oz., brass 1 oz., cawk-stone red-hot $\frac{1}{2}$ oz.; excessively difficult to fuse, and of a dirty light brown colour, and somewhat malleable.

64. Copper 32, tin 16, iron-filings 4, regulus of antimony 4, and fluxed with corrosive sublimate; an exceeding hard and compact metal, but of too blue a colour.

65. Copper 2 oz., tin 1 oz., iron-filings 1 dr., regulus of antimony 1 dr.; too blue a colour, and rough-grained.

66. Regulus of antimony and tin, equal parts; sparry, and not fit for mirrors.

67. Cast-steel; will not polish upon pitch, either with putty, or colcothar of vitriol.

68. Steel 1, tin $\frac{1}{4}$; very rough-grained and bluish, and not much different from steel itself.

69. Steel 1, tin 1; rough-grained, and of a bluish colour.

70. Steel 1, and forty-seventh composition 20 parts; rough-grained, and not near so good as forty-seven.

71. Steel 1, and forty-seventh composition 30; not much different from the forty-seventh composition, but not so beautiful and close-grained.

ABSTRACT OF POPPE'S HISTORY OF CLOCK AND WATCH MAKING, AND OF THE METHOD OF DIVIDING THE DAY AT DIFFERENT PERIODS OF TIME.

The oldest Method of Dividing the Day, and the Invention of Sun Dials.

The period when, is as little known as the country where, and the person by whom, sun-dials were invented. M. Poppe, however, has collected from the oldest authors what is to be found on the subject, and examined it with critical accuracy. The earliest account of instruments destined to mark the lapse of time by the sun's shadow is to be found in the Bible and in Homer. A sun-dial constructed according to the description of Vitruvius, was found in the year 1741, among the ruins of a villa on the Tusculan hill at Rome. A sun-dial of the same kind is still to be seen at Athens, standing on the summit of a rock, to the right of an edifice built by Thrasyllus.

Use of Sun Dials, and the Division of the day into Hours, among different ancient nations; gradual improvement of the art of constructing and using them, to the present period.

The Indians, Siamese, Tartars, Persians, Chaldeans, Egyptians, and Chinese divided the day into 60 hours, and each hour into 60 minutes, &c. These people, even employed a gnomon for the purpose of placing their temples according to the principal quarters of the globe. We know from history that the Chinese made use of gnomons 12 or 15 centuries perhaps before the birth of Christ. The old geographers, by examining the length of the shadows of gnomons of equal height, determined the latitude of places, and the obliquity of the ecliptic. Berosus brought to Greece from Asia, the first sun-dial, and the division of the day into twelve hours; Anaximander, about six centuries before Christ, made an improvement in sun-dials, as did also Anaximenes. Eudoxus, four centuries before Christ, constructed a still more perfect sun-dial, under the name of *arachne*. Apollonius of Perga, about a century before Christ, invented the *pharetra*. Patrocles found out the *pelekinon*, Dionysiodorus the sun-dial in the form of a cone, Cleanthes the hemisphere or *scaph*, Parmenio the *prostapistorumena*, Theodosius and Andreas the *prospanklima*. Vitruvius makes mention of three other sun-dials, *gonarcha*, *engenaton*, and *antiboreum*, without describing them or naming their inventors. The author describes all these sun-dials, with as much precision as the accounts of them remaining will allow, and with literary and technical accuracy. There were public sun-dials both at Athens and Sparta. Eratosthenes and Archimedes, employed dials very accurately divided for astronomical purposes; and all the cities of Greece of any consideration soon had public instruments of this kind. Ring-dials soon began also to be used. A dial of this kind was suspended in the large ship of Hiero; but the Grecian navigators, for measuring the state of the sun, the time of the day, and the stars above the horizon, employed rather the hodometer described by Vitruvius, which seems to have furnished the first hint for our measurers of time, constructed with wheel-work. It was very late before the Romans had real sun-dials. They employed in their stead obelisks, to which good gnomons were applied. The largest of all the gnomons of modern times, was that of Ulug Beigh, erected at Constantinople in the 15th century, which was 183 feet in height. The Bononian obelisk, 83 feet high, erected by Cassini, that of Paris, and the one which Pope Clement XI. caused to be constructed, are also celebrated. In the ancient gnomons, the hours were indicated by the shadow of a style; in the modern ones the same thing is done by the sun's rays passing through a hole. The Greeks and Romans employed persons of both sexes, to announce to them the hours, as indicated by the public gnomons. Trimalchio caused the hours to be announced to him by a trumpeter.

This was afterwards customary at the temples. It is not known, however, when portable sun-dials came into use. Some of these instruments, after being buried more than 15 hundred years, were found between 1730 and 1740, in the territories of Rome: of these remains of antiquity the history gives a description. That Purbach, an astronomer of Vienna, introduced sun-dials into Germany about 300 years ago is not probable, as the Germans, no doubt, obtained them by their intercourse with the Romans. In the 16th century, artists took great pains to construct sun-dials, in a great many ingenious ways; about the same period, lunar and astral dials were invented. There is a sun-dial at Besançon which is seen only when the sun shines. This M. Poppe describes, as well as the dial below the roof of the council-house at Ingoldstadt. Another at Alençon, still more ingenious, is connected with wheel-work, and indicates true and mean time. In the museum at Göttingen there is a collection of sun-dials, and other works of art of a similar kind, preserved in a box.

Oldest Method of Dividing the Night. Invention of water-clocks and sand-glasses, and the progressive improvement of them to the present time.

The circumstance of sun-dials being of no use in the night time, and during cloudy weather, gave occasion to the invention and improvement of water-clocks; traces of which may be found among the oldest nations, the Chaldeans and Egyptians. They were in use also at an early period among the Chinese. They were employed by the Egyptian astronomers, for measuring the diameter of the sun. In their first state, they were called *clepsydræ*, because the water issued from them drop by drop. The defect, in regard to the inequality in the efflux, was at first remedied by the small stick of the Indians, having a hole bored in it, and which floats some time on the water, but which, after a certain period, discovered by repeated trial, becomes immersed. It was afterwards contrived to keep the water-clock always full, by suffering the same quantity of water to run in, as that which flowed out, that equal portions of time might be indicated by an equal fall. A funnel, or inverted pyramid was then employed, in which the water descended in unequal parts, but through equal degrees marked out on a scale. In the course of time, the knowledge of astronomy was applied to these clocks, and some were constructed in a very ingenious manner: of this kind was the *anaphoricum*, which the author describes; also the retrograding clock, and winter water-clock. Plato brought the first water-clock to Greece. The first that ever appeared at Rome, was shown by Scipio Nasica, about the year 157 before Christ: but soon after, these clocks were common, not only at Rome, but in other towns of the Roman empire. When Julius Cæsar invaded Britain, he found that the inhabitants had water-clocks. In general, they were more prized than sun-dials. Athenæus constructed a clock, which indicated the hours, by the hissing noise of the air forced through a narrow hole, by the pressure of water. Together with public sun-dials, public water-clocks were also soon introduced. These were established even in the palaces of the great. That the hours as announced by these water-clocks, may be more easily made known to the public, the Turks have criers posted on high towers,—and the Chinese, persons who strike on large bells. The Japanese employ burning matches to indicate the time, and announce the hours in the same manner as the Chinese. The use which Hipparchus and Ptolemy made of water-clocks, contributed to their improvement: they were much improved by Hero, but during the next seven centuries, nothing was done in this respect. The clocks of Boethius, that which Harun al Raschid sent as a present to Charlemagne, and that of the philosopher Leo of Constantinople, were much celebrated, though the invention of clocks with wheel-work, rendered water-clocks unnecessary. The latter, however, continued some time after in use; and about the year 1660, water-clocks in the form of a drum, which are those called properly at present water-clocks, were invented it is probable in Italy, but rather for curiosity than for real use. The observation that the water soon evaporated, may have given occasion to sand being used in such clocks, instead of water. The period when this change was made is not known. There is reason only to conjecture, that the Egyptians and Chaldeans had hour glasses. In the Monachal Laws, the word *klepsammidia* occurs only in writings of the eighth century; and it was not till a much later period, that attempts were made to construct hour glasses, in an elegant and ingenious manner. Many of them are described by Francis de Lanis, as well as by Schott and Ozanam. Rivault employed such sand glasses for astronomical observations; and likewise Tycho Brahe, who used also clocks constructed with quicksilver.

Ingenious water-clocks and other machines, the moving principle of which was different from that of our common Clocks, that go by wheel-work.

Under this head, the history speaks of the machine which king Gonebaud received as a present from Theodoric, king of the Goths. It gives also a description of the before-mentioned clock, sent by Harun al Raschid to Charlemagne. At that period, the eastern princes presented clocks to the western; at present, this mode is reversed. Some other ingenious clocks, from Schott, Kircher, Ozanam, Martinelli, and de Lanis; also Perrault's pendulum-clock, which was moved by water, and a Chinese one, which Y-Hang caused to be constructed, belong also to this class.

[TO BE CONTINUED.]

Process for Dying Nankeen colour. By MR. RICHARD BREWER.

MIX as much sheep's dung in clear water, as will make it appear of the colour of grass, and dissolve in clear water one pound of best white soap, for every ten pounds of cotton-yarn, or in that proportion for a greater or lesser quantity.

Observe:—The tubs, boards, and poles, that are used in the following operations must be made of deal; the boiling-pan of either iron or copper.

First Operation.

Pour the soap liquor, prepared as above, into the boiling-pan; strain the dung liquor through a sieve; add as much thereof to the soap liquor in the pan, as will be sufficient to boil the yarn, intended to be dyed, for five hours. When the liquors are well mixed in the pan, enter the yarn, light the fire under the pan, and bring the liquor to boil in about two hours, observing to increase the heat, regularly, during that period. Continue it boiling for three hours, then take the yarn out of the pan, wash it, wring it, and hang it in a shed on poles to dry. When dry, take it into a stove or other room where there is a fire; let it hang there until it be thoroughly dry.

N. B. The cotton yarn, when in the shed, should not be exposed either to the rain or sun: if it is, it will be unequally coloured, when dyed.

Second Operation.

In this operation, use only one half of the soap that was used in the last, and as much dung liquor, (strained as before directed,) as will be sufficient to cover the cotton yarn, when in the pan, about two inches. When these liquors, are well mixed in the pan, enter the yarn, light the fire, and bring the liquor to boil in about one hour; then take the yarn out, wring it without washing, and hang it to dry as in the former operation.

Third Operation.

This operation the same as the second, in every respect.

Fourth Operation.

For every ten pounds of yarn make a clear ley from half a pound of pot or pearl ashes. Pour the ley into the boiling-pan, and add as much clear water as will be sufficient to boil the yarn for two hours; then enter the yarn, light the fire, and bring it to boil in about an hour. Continue it boiling about an hour, then take the yarn out, wash it very well in clear water, wring it, and hang it to dry as in former operations.

N. B. This operation is to cleanse the yarn, from any oleaginous matter that may remain in it after boiling in the soap, and dung liquors.

Fifth Operation.

To every gallon of iron liquor* add half a pound of ruddle, or red chalk, (the last the best,) well pulverized.

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* Iron liquor is what the linen printers use

Mix them well together, and let the liquor stand four hours, in order that the heavy particles may subside; then pour the clear liquor into the boiling-pan, and bring it to such a degree of heat as a person can well bear his hand in it; divide the yarn into small parcels, about five hanks in each; soak each parcel or handful very well in the above liquor, wring it, and lay it down on a clean deal board. When all the yarn is handed through the liquor, the last handful must be taken up and soaked in the liquor a second time, and every other handful in succession, till the whole is gone through; then lay the yarn down in a tub, wherein there must be put a sufficient quantity of ley made from pot or pearl ashes, as will cover it about six inches. Let it lie in this state about two hours, then hand it over in the ley, wring it, and lay it down on a clear board. If it does not appear sufficiently deep in colour, this operation must be repeated till it has acquired a sufficient degree of darkness of colour: this done, it must be hung to dry as in former operations.

N. B. Any degree of red or yellow hue may be given to the yarn, by increasing or diminishing the quantity of ruddle or red chalk.

Sixth Operation.

For every ten pounds of yarn make a ley from half a pound of pot or pearl ashes; pour the clear ley into the boiling-pan; add a sufficient quantity of water thereto, that will cover the yarn about four inches; light the fire, and enter the yarn, when the liquor is a little warm; observe to keep it constantly under the liquor, for two hours; increase the heat regularly till it come to a scald; then take the yarn out, wash it, and hang it to dry, as in former operations.

Seventh Operation.

Make a sour liquor of oil of vitriol and water; the degree of acidity may be a little less than the juice of lemons; lay the yarn in it for about an hour, then take it out, wash it very well, and wring it; give it a second washing and wringing, and lay it on a board.

N. B. This operation is to dissolve the metallic particles, and remove the ferruginous matter that remains on the surface of the thread after the fifth operation.

Eighth Operation.

For every ten pounds of yarn, dissolve one pound of best white soap in clear water, and add as much water to this liquor in your boiling-pan, as will be sufficient to boil the yarn for two hours. When these liquors are well mixed, light the fire, enter the yarn, and bring the liquor to boil in about an hour. Continue it boiling slowly an hour; take it out, wash it in clear water, very well, and hang it to dry, as in former operations: when dry, it is ready for the weaver.

N. B. It appears to me, from experiments, that I have made, that less than four operations in the preparation of the yarn, will not be sufficient to cleanse the pores of the fibres of the cotton, and render the colour permanent.

Instructions for making Red Crayons. *By* A. F. Lomet.

It is not without difficulty, that crayons of a good quality can be obtained for drawing schools, particularly at a distance from the metropolis. The native ochre sawed into pieces, which are commonly used, is almost always hard and of an uneven and gravelly consistence; so that the outlines in drawing, for which it is used, cannot be made either with the softness or the precision requisite to produce the desired effect. The only good crayons that can be procured have been hitherto manufactured in Paris exclusively, where they have been long sold at a very high price. The best are known by the name of crayons *de páte du Desmarest*, who was probably the inventor. None of those who have written on the composition of those crayons, have mentioned the quantity of ingredients which ought to be employed. I have made a series of experiments on all the combinations possible to be made, with the substances proper for that fabrication. I have rejected those products that have not answered the purpose of my inquiries, and I here offer those processes which have afforded satisfactory results.

These crayons are composed of soft ochre, which is an oxide or bog ore of iron, containing a mixture of earth, of the nature of the clays, which we call hematite. They incorporate it with some binding substance, such as lime, glue, or rosin, mixed sometimes with soap, to take off the hardness of the composition. Instead of the ochre, called Sanguine in French, the other ochres, such as those known by the name of brown-red, or colcothar of vitriol, may be used. In this case, it is necessary to choose them soft to the touch, and of a lively colour, those that are intended for sale, being often mixed with clay; which gives them a yellowish and dull colour, and ought consequently to be avoided.

I have made the experiment of incorporating those substances with the white of eggs and the albumen of the blood; but the crayons were not of a good quality. The softest ochre should be taken, and ground with pure water on a marble, as practised with the colours used for painting, observing to moisten it no more than may be absolutely necessary, to facilitate the sliding of the mullar.

When the operation of grinding in the large way becomes difficult, and too expensive, another method may be practised, to divide the colouring matters. After pounding, they are sifted through a silk sieve, then diluted with much water, in tubs, and after strong agitation, left to settle for a few minutes; that is to say, for the time, sufficient to suffer the coarsest particles to fall to the bottom. The water highly charged with the finest parts, is then drawn off, and left to settle for four and twenty hours, when the clear water is also decanted off. A very fine powder is thus obtained. The coarse remainder is to be ground and treated in the same manner, till the whole mass be reduced to a state of extreme division.

The gum, the glue, or the soap intended to give a sufficient degree of solidity to the crayons, are to be separately dissolved, and the solutions worked up with the grinded ochre. The mixture is then dried by exposing it to the sun, or before a fire by a very moderate heat, taking care to stir it often, till the paste has acquired the consistence of butter.

The crayons are then to be fashioned or moulded, which may be done in two ways. The first consists in spreading the paste upon a board, in which a number of channels or half round grooves are made, of an indeterminate length, but of a depth and width proportioned to the size of the crayons intended to be manufactured. The second method, which is the best, consists in pressing the paste through the pipe of a syringe, whose orifice is equal to the size of these crayons. The pieces when moulded in this manner, are left to dry. This desiccation ought to be performed slowly, and in the shade, to prevent cracks, which would be formed, if this precaution were not attended to.

When the pieces are dried, they are to be divided into lengths of two inches (or five centimetres) each; the edges are rounded off, and they are roughly pointed. They must then be scraped, to remove a hard external surface which they acquire during their drying, and would prevent their marking.

A slight coating of oil must be smeared over the wooden moulds, to prevent the paste from adhering to the sides.

Gum arabic and isinglass are to be preferably used. The gum and soap may be dissolved in water; but the isinglass must be first cut into small pieces, afterwards put into warm water, and dissolved on a water-bath. These solutions must be sufficiently liquid to pass through a hair-sieve, and leave their impurities behind.

It is not without difficulty that the paste incorporates with the solution of glue. Both must be warm, and the mixture must be made over the fire at the boiling water heat.

The paste must be well mixed together before it is put into the moulds, in order that it may be uniformly incorporated with the solution, and leave no hard parts. It would be better to work it with the painter's mullar, and to grind it for a short time on the stone, before it is put into the moulds.

It is only in the crayons, which contain gum, that soap can be admitted. None of the experiments in which glue and soap have been used together, have ever succeeded; and it must be so, because the excess of the alkali of the soap acting on the gelatine destroys its adhesive quality.

As those crayons, into the corporation of which soap enters, are found to afford a darker shade, it seems that this combination takes a portion of the oxygen from the red oxide of iron, and renders it brown by bringing it nearer to the state of the martial ethiops. I have observed that all the pastes prepared with the oxide of iron, even if with mere water, become brown on their exterior surface during the drying. This effect takes place in a more evident manner, when they are exposed to the sun; and it appears to arise from the light taking a portion of the oxygen from the oxide of iron. I shall hereafter return to the chemical properties of these kinds of preparations, but my present purpose is only to describe those processes of fabrication in which I have constantly succeeded, in order that they may be repeated with success.

The crayons composed after these directions have all the good qualities which can be required; they do not cost one-fourth of the price of those in the shops; but it must be noticed that their composition requires great exactness in the quantity prescribed, because the least alteration, occasions a considerable difference in the quality of the paste. It is particularly necessary to guard against those errors which may happen from inevitable diminution, during the time of the manipulation. The best way to prevent this, will be to ascertain by experiments, the quantity of water and ground ochre which these solutions may contain before mixing them.

By means of the quantities stated in the following table for each of those kinds of crayons, it will be easy to know the proportional quantities of gum, glue, or soap, which may be employed for a determinate weight of ochre or red oxide of iron.

Substances to be employed, with their quantities and results.

No. 1.		
Dry ochre, or red oxide of iron	10. gram.	These crayons are very friable, but they may be used for large drawings. These contain the least possible quantity of gum. If less be used they will not have sufficient consistence to be of any use.
Dry gum arabic	1.311 gram.	
No. 2.		
Ochre, &c.	10. gram.	Soft crayons, rather friable, and excellent for large drawings.
Gum,	0.363 gram.	
No. 3.		
Ochre,	10. gram.	Smooth and solid crayons fit for common use.
Gum,	0.415 gram.	
Or still better, with	0.441 gram.	
No. 4.		
Ochre,	10. gram.	Soft firm crayons, for drawings which require delicacy and precision.
Gum,	0.467 gram.	
No. 5.		
Ochre,	10. gram.	Very firm crayons, fit for small drawings, which require to be highly finished.
Gum,	0.519 gram.	
No. 6.		
Ochre,	10. gram.	Crayons almost too hard to be used. This is the maximum of gum that can be employed in their composition.
Gum,	0.571 gram.	

No. 7.

Ochre,	10. gram.
Gum,	0.380 gram.
White dried soap,	0.519 gram.

These crayons are of a darker colour than the others mentioned; they are of a very hard consistence, and soft to the touch; but all crayons into whose composition any soap enters, have the defect of making strokes which shine too much when retouched. None of my experiments with soap succeeded. These crayons very much resemble those of the composition of *Desmarest.*

On various Compositions for Blacking and Polishing Leather.

Various compositions are used to give a sort of polish or varnish to leather, by being brushed over it. The blacking that has been most generally used for some years past, in France, was composed of the whites of eggs, beaten up with water; to which were added a little lampblack, to colour it; and some sugar, or gum, to render it shining. It was sufficient to spread this mixture over the leather with a brush, and allow it to dry.

This blacking is very beautiful, and easy to be made and used; but it has its inconveniences: it is not very solid; heat causes it to scale off; and it is dissolved by the least quantity of water that touches it. Humidity alone, is sufficient to cause it to come off, on the least friction. It is now but little used in large towns, as the following superior composition is substituted for it; viz.

Ivory Black,	3500 grammes.*
Molasses,	3500
Sulphuric Acid,	450
Hydrochloric or Muriatic Acid,	450
Weak Acetic Acid,	1700
Gum Arabic,	200
Linseed or Olive Oil,	200
	10,200

The sulphuric acid, is diluted with six times its weight of water, which must be mixed with some precaution, adding it by degrees, that the temperature may not be too rapidly raised, or there is great risk of breaking the vessel. A mixture is then made of this diluted acid, with the hydrochloric acid and molasses, in a large earthen vessel. The ivory black, previously mixed with a sufficient quantity of water, to make it of a moderately thick consistence, is then added by degrees to the acidulous liquid, stirring it all the while, not only for the purpose of disengaging the gas which is generated, but also to prevent the mixture from forming into a mass, or coagulating. When the mixture is well blended together, it is diluted with weak acetic acid, or common vinegar; and the gum, previously dissolved

* The gramme is nearly equal to 15½ English grains.

in four or five times its weight of water, is then added, with the oil. The whole is then again well stirred together; and, finally, a sufficient quantity of water is added, to increase its volume to 17½ litres,* which will produce 70 bottles of blacking, of a quarter of a litre each. This blacking is sometimes scented with an essential oil, such as that of rosemary, &c.

The mixture must be constantly agitated, while putting into the bottles, in order that the heavier and lighter parts may not separate from each other. This blacking, when it is sent to any great distance, or remains long in the shops, is susceptible of entering into fermentation; and the great quantity of carbonic acid formed, during the conversion of the saccharine matter (the molasses) into alcohol, exerts a pressure in the bottles, and renders them liable to burst; or, when the cork is drawn, to occasion the effervescing liquid to fly out: to prevent which, it is sufficient to cause the corked bottles to be boiled in water for half an hour, in M. Appert's mode; but it is probable that the same end may be accomplished by mixing a small quantity of the sulphurous acid with the blacking. Whenever the blacking is to be used, it must also be shaken or stirred up, in order to mix those parts again, which are apt to separate on standing.

This composition is effected by the re-actions of the sulphurous and hydrochloric acids upon the *ivory-black;* also by the hydrochlorate, the sulphate and the phosphate of lime formed; the carbon, and the other ingredients employed in its preparation, sustaining very little alteration from their mixture. This composition being spread upon the leather, and rubbed over, while it is wet, with a rather hard brush, makes it acquire a beautiful, brilliant, and black polish; it adheres closely to the leather, and is not removed by any slight friction, not even in damp weather. The hydrochloric or muriatic acid, which is employed in an equal quantity with the sulphuric; or is about a third part of all the acids used in the composition, forms with the lime a soluble deliquescent salt, which enters, and gives a softness to, the leather, and does not produce that dull appearance which results from an excess of the sulphate of lime.

This article forms a very important branch of commerce in England; considerable quantities of it being exported; and, in the large manufactories, steam-engines are employed in its preparation.

Some years since, I pointed out a more economical mode of making a blacking, which is yet equally beautiful with the above: it consists in substituting for the molasses and gum, either the fecula of potatoes, or the potatoes themselves, saccharized by the action of the sulphuric acid; and for the *ivory-black*, animal or bone charcoal, ground in water. It is made in the following manner: supposing all the ingredients, except those substituted, to be used in exactly the same proportions as we have above given.

Either the fecula, or the potatoes, after being boiled and crushed, so as to be reduced to a gelatinous state, are to be mixed with tepid water (at about 45°;) and sulphuric acid, previously diluted with ten times its weight of water, is then poured on it by degrees, and the whole brought to a boiling heat in a leaden vessel; being careful to keep the acid mixture and the fecula, or potatoes, well stirred together, and to make the additions in such small quantities, as to interrupt the ebullition as little as possible. Two or three minutes after the last addition has been made, the starch is completely saccharized; the vessel must then be taken off the fire; without which precaution the saccharine matter would very soon become scorched. The mixture is then allowed to cool gently, and during this time the hydrochloric acid is poured upon the animal charcoal by small portions at a time, and stirred with a wooden spatula; and this part of the process is finished, by mixing this charcoal in the saccharine liquid and acid, when the sulphuric acid acts with as much energy as in the former process.

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* The litre is nearly equal to 2⅛ wine pints.

This mixture is then boiled to a rather thick consistence, and is passed through a colour-mill. The mill is previously washed, by throwing into the hopper the remainder of the acid liquid or vinegar, and then pure water; and these washings are put into the blacking; finally, the other ingredients are added, together with a sufficient quantity of water, to increase its volume to 17 litres and a half, as in the former process.

The blacking thus obtained is absolutely the same as the other: the fineness of the black, which enters into the composition, is even more equal.

We also find, in commerce, many other kinds of blacking, formed of resins, gum-lac, spirit of wine (alcohol,) lamp-black, ivory-black, and other substances, in great number, and in various proportions; but they are very little used. P.

[*Dictionnaire Technologique.*

A cheap and efficacious Method for Destroying Rats and Mice; recommended to the Agriculture Society of Manchester. By Mr. C. Taylor.

In, or near the places frequented by these vermin, place upon a slate or tile, one or two meat spoonfuls of dry oat meal; lay it thin, and press it flat, that you may more easily know what is taken away. The rats, if not interrupted, will come regularly to feed there; supply them thus with fresh oatmeal for two or three days; then, to about six spoonfuls of dry oatmeal, add three drops of oil of aniseeds; and having stirred the mixture well together, feed them with this for two or three days more; then for one day give them only half the quantity they have usually eaten of this scented oatmeal, and on the following day, place the following mixture:

To four ounces of dry oatmeal, scented with six drops of oil of aniseeds, add half an ounce of carbonate of barytes, previously pounded very fine in a mortar, and sifted through a little fine muslin or cambric: mix this intimately with the scented oatmeal, and lay this mixture of oatmeal and barytes upon the tile or slate, as the oatmeal had been usually placed, and allow the rats to come and eat of it for twenty four hours, without interruption.

A few hours after eating thereof, you will frequently see some of them running about as if drunk, or paralytic, but eventually, they generally all retire to their haunts and die. As rats are extremely sagacious, it may be proper, where they have only eaten a small portion, to allow the mixture to remain for forty-eight hours. It will be best to burn what is left after that time, as a fresh mixture may be prepared at a trifling expense, when wanted.

During the time in which the mixture of barytes is exposed to the rats, it is necessary to keep shut the doors of the places where it is laid, to prevent the vermin from being disturbed, or a possibility of accident to any other animal or person; for though it is not so extremely dangerous, if taken internally, as the preparations commonly employed for killing rats, and is even in some cases used in medicine, yet it is fatal if taken improperly.

The oil of aniseeds renders the mixture disagreeable to dogs, and many other animals, but is, in small quantities, alluring to rats.

Carbonate of barytes, is tasteless, semi-transparent, and effervesces with acids: it is moderately hard and striated. It is frequently called aerated barytes (*terra ponderosa aerata.*) and sometimes, by the miners, ponderous spar.

ON GILDING.

On the Preparation of Gold, and the art of Gilding in size, oil, &c.

We have already given a description of the mode pursued in France, in the various kinds of gilding upon metals, wood, and other substances, and now present a view of the English practice, in some of the processes of this art, as given in Gill's Technical Repository.

The art of *gilding*, or laying a thin superficial coating of gold, on wood, and other substances, has been long practised and highly esteemed, both for its utility and the splendid effect which it produces. Gold, from its great beauty, and from the length of time, during which it may be exposed to the action of the air, without tarnishing, is unquestionably the most valuable of all substances, for the purposes of decoration: but, on account of its great price and weight, it can only be used for general purposes, in the shape of a thin skin, or leaf, as it is usually called. Gold is the most malleable and ductile of all substances; and therefore, a given weight of it, notwithstanding its high specific gravity, may, by beating, be made to cover a larger surface than an equal quantity of any other body whatever.

The different states in which gold is used, for the purposes of gilding, are the following: first, in the shape of leaf gold of different degrees of thickness, and formed either of the pure metal, or of alloy of this with silver: second, as an amalgam of gold; and, third, in gold powder.

OF LEAF GOLD.

The leaf gold is procured by the gilder, from the gold-beater, whose art consists in hammering a number of thin rolled plates of the metal between skins, or animal membranes.

OF GOLD AMALGAM.

The amalgam of gold is made by heating in a crucible some pure quicksilver; and, when it is nearly in the boiling state, about the sixth part of its weight of fine gold in thin plates, heated red hot, is to be immersed in it. The mixture soon becomes homogeneous; and then it is allowed to cool. When cold, it is to be put in a piece of soft leather; and, by gradual pressure, the fluid part of the amalgam, consisting almost wholly of mercury, may be forced through the pores of the leather; while the gold, combined with about twice its weight of mercury, will remain behind, forming a mass, of the consistence of butter. This, after being bruised and ground in a mortar, or shaken in a strong phial, with repeated portions of salt and water, till the water comes away quite clear and unsoiled, is fit for use; and may be kept for any length of time, without injuring, in a corked phial.

It is of the utmost importance, that the materials of the amalgam, and especially the mercury, should be perfectly pure; as the least portion of lead or bismuth, would very materially injure the beauty of the gilding, by deteriorating the colour of the gold, and filling it with black specks.

OF GOLD POWDER.

Gold in powder is prepared by three different methods: the first and most simple is, to put into a glass or earthenware mortar, some gold leaf, with a little honey, or thick gum-water,* and to grind the mixture for a considerable time, till the gold is reduced to extremely minute fragments: when this is done, the honey or gum-water may be washed away, leaving the gold behind, in a minute pulverulent state. A more effectual and quicker method of reducing gold to a state of powder, is, to dissolve it in *aqua Regia*, or, as it is denominated in the new chemistry, in nitro-muriatic acid, and then precipitate it with a piece of copper. The precipitate, after being digested in distilled vinegar, and then washed with pure water and dried, is in the form of a very fine powder; and is said to work better, and is fitter for burnishing, than the powder obtained from leaf-gold. The very finest ground gold is produced by heating gradually the gold amalgam, already described, in an open earthen vessel, and continuing it over the fire till the whole of the mercury is evaporated; taking care that the amalgam shall be constantly stirred with a rod of glass, to prevent the gold from adhering in lumps, as the mercury flies off. When the mercury is completely evaporated, the residual gold, being then ground in a Wedgewood-ware mortar, with a little water, and afterwards dried, is fit for use.

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* Loaf-sugar ground in the dry state with the leaf gold, and afterwards separated by washing, is preferred by some; we have used common molasses, and have not seen reason to wish for a better article. A large quantity of water must, in any case, be used in the washing. EDITOR.

Gilding is performed either with or without heat. By the first of these methods, those substances are gilt which are not liable to alteration, by exposure to a moderate heat; such as, metals, glass, and porcelain. The second method is practised with those substances, as wood, paper, lead, &c., which would be destroyed by being raised to a temperature requisite for gilding the former. Our business is chiefly with wood.

Gilding on wood, both in oil and varnish, is at present in its highest perfection, and is executed in London better than in any other part of the world. That which is brought from France, and other parts of the continent, is by no means equal to it: not that it is to be inferred, from hence, that gilding is well executed by all who undertake it in the metropolis. Many men, who have worked there all their lives, are unable to gild properly a common picture-frame, though they get employment. It is however hoped, a better judgment will be formed from the instructions here given; from which it has been known, that a person bred a cabinet-maker, and who never saw gilding performed, has accomplished the work in the best style, in the course of six months' practice.

BURNISHED GILDING ON WOOD.

To begin with picture-frames, or mouldings, which are the simplest works performed in this branch.—Put into an earthen pan, that will hold a quart, three half pints of strong size, the composition of which will be described hereafter: make it very hot over the fire, but do not let it boil: add some of the best whiting, powdered fine; mix them with a brush kept for the purpose, or beat them up with a piece of lath, &c. as an egg is beaten, till they become thoroughly incorporated, and of the consistence of thick cream: put a little of this mixture, with an equal quantity of strong size, into a smaller pan; heat it till near boiling; and, with a stiff brush, lay it over the whole work, in order to clear away any dirt, grease, or hand marks: this is called *thin-whitening* the work, and makes a ground for the other operations. When the wood, however, is very dirty, it is absolutely necessary to wash it all over with a sponge and hot water, before the thin white is applied; which precaution will prevent the chipping-up of the preparation. When burnished, the thin white should be particularly well dried: after which, the work is to receive four coats more of that composition which was made, as described, of the consistence of cream, warmed, but not made so hot as for thin whitening;

taking care that one coat is dry, before another is applied. And here it is necessary to observe, once for all, that, throughout this process, one coat must always be dry, before another is laid on, whatever may be the composition used. The sixth coat, which is also of *thick white*, must be laid on, by passing the brush in a smooth, even and flowing manner, over two feet in length of the work at a time, in order to gain a surface, and facilitate the smoothing, hereafter to be described. Before the whitening is dry, the flat parts should be rubbed down with a chisel, the hollows with a gouge, and the rounds with the finger or fingers, as may be most convenient: should the hollows be too large for a gouge, the finger will answer every purpose. When dry, any superfluous whitening, that may have fallen over the edges of the mouldings, &c. may be lightly pared off with a chisel or gouge, according as the parts are situated: then give it a seventh coat, similar to the preceding; and it will be ready for smoothing, which should be performed in the following manner:

Take some close-grained pumice-stone, and, with a sash-saw, (an old one will answer the purpose,) cut it into pieces, about three or four inches long, (if the work be very small, an inch, or an inch and a half will do;) fit them to the different mouldings, using a rasp to form the rounds, and a gouge for the hollows. The flats are to be made by rubbing the pieces of pumice-stone on a smooth flat stone, making their sides at right-angles to each other, that they may smooth two sides at once. During these operations, the pumice-stones must be frequently dipped in water. Lay the pieces thus prepared in a large earthen pan full of water, not less than two quarts; then take a hog's-hair brush and a sponge, both of convenient sizes: dip the brush in water, and wet about two feet in length of the work at a time, taking the mouldings alternately: then with the pumice-stone, already fitted, rub up and down, till a smooth surface is obtained: remove the water with the brush, and squeeze it into the pan: what water remains may be taken off with the sponge, which will complete the smoothing of that part. Proceed in the same manner with similar portions; for if too much be wetted at a time, the whitening becomes soft, and unfit to bear the pumice-stone. The frames must then be set aside to dry.

In carved work, the whitening and smoothing differ somewhat from the preceding. After the thin white is dry, the coats that follow must be rather weaker; or not so thick as for frames or mouldings: they are to be laid on, by carrying the brush over the work in an even and smooth, but not flowing manner. To smooth them, or produce the surfaces that are required, pieces of lime-wood, or fir, soaked in water, are used instead of pumice-stone; and are shaped round, flat, or angular, as may be found necessary, occasionally wrapping around them strips of coarse linen cloth. In smoothing, care must be taken not to rub off too much of the whitening, or the gilding will look poor; and it would prevent the burnishing of those parts which were thereby brought too near to the wood. The drying may be hastened in summer, by the sun; or, in winter, by placing the work before a fire; but not too near, or the whitening would chip off. Mix a little strong size with four times as much water, in a half-pint earthen pan: the proportions should be so adapted, as to make it three parts full: for instance, the quantity of size may be equal in bulk, to two large walnuts, and half as much prepared yellow ochre must be added to it: mix the ingredients well together; and, with a brush, coat the work once over therewith: when dry, rub it slightly with glass-paper, half worn out, to improve the surface; and proceed to mix, and lay on the gold size as follows. In another half-pint earthen pan, half full of clear size, mix a quantity of burnished gold size, twice as big as a large walnut, with which coat the work twice over. When dry, burnish the parts intended to be matted, with an agate burnisher; and then give it another coat of the same gold size. The size must now be reduced, by adding to it about two tea-spoonfuls of water, and as much gold size as you can take upon the point of a knife: with this, coat those parts only that are intended to be burnished. And here it must be observed, that in laying gold size on carved work after it is yellowed, those parts should be missed that are too small to receive the gold, even from the smallest pencil; such as the small eyes of foliage, &c.; effect to which must afterwards be given, with high coloured *or moulu*. We may now proceed to lay on the gold with a cushion-knife and tip, as will be described in oil-gilding: but in burnish-gilding, camel's-hair pencils must be used for small parts, and swan-quill pencils for the larger ones, dipped in clear water, to wet the work as fast as the gold can be laid on. The hollows and flats must be gilt first, and be perfectly dry before the other parts can be proceeded with: when the work is all gilt, and dry, burnish the parts intended to be so treated. Should there be any faults, which can only arise from the parts not being carefully wetted, or from grease, those parts must be rubbed through to the whitening, by means of linen wrapped round the finger: when they are dry, they must be gold-sized, gilt, and burnished.

Then reduce a little clear size with hot water; so that, when cold, it will merely set: this, being the weakest size used in burnish-gilding, much care should be taken that it be not too strong, or it will show all the joints of the gold. Lay on a coat of this; and when completely dry, rub it over with cotton-wool. In double gilding, which is the best style, the matted parts should be again gilt, using water to wet as before; after which, coat them again with the weak size, use the cotton, and, if faults appear, treat them as will be directed in '*oil-gilding not to stand the weather.*' After the faults are all covered, give them another coat of the weak size, use the cotton, and then give a coat of clear size, to keep the gold firm: a coat of *or moulu* completes the process. Observe, swan-quill and camel's-hair pencils only are used, after the gold is laid on; and care must be taken, in sizing the matted parts, not to touch those that are burnished, which cannot be improved after the burnishing-stone.

If it be necessary to embellish the frames, or other work to be gilt, with composition ornaments, they may be had, in London, soft from the press; and can be put on, after the smoothing, with a little hot thick whitening, or weak glue. What is squeezed out round their edges, in pressing them close, may be taken off with a brush and cold water: they must then have a coat of thin white, to remove any grease, and be finished like the rest of the work. The composition ornaments may also be put on oil-gold work, that is not to stand the weather, but does not then require the thin white: they must be finished in the manner of oil-gilding. Composition ornaments are easily moistened, when dry, by wrapping them in a wet linen cloth for twenty-four hours.

[TO BE CONTINUED.]

On the Preparation of Enamel Colours, and Fluxes; and the Vehicles for laying them on with. By Mr. ROBERT WYNN.

[From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.]

PAINTING in enamel colours has always been considered interesting, and is one of the most costly productions of art, in every country where practised; but the real preparation of the colours has always been confined to the knowledge of a few persons, who have made a mystery of it; and whatever has been yet published on the subject, appears to be chiefly the compilation of writers unskilled in the profession. Many artists of superior talents, in different parts of this country, could practise the art, but for the difficulty of procuring a good set of colours: indeed it is extraordinary with what suspicious secrecy the art of making enamel colours has hitherto been conducted. I have been acquainted with several of the best manufacturers, whose colours were used by the most eminent painters, on the finest and most elaborate works of the time; but who have died without ever benefitting their country by publishing their acquirements, or leaving any documents behind them. It is not indeed impossible, that the present improved state of knowledge in the art, might be entirely lost, were not some experienced professional person to seek an opportunity of making it public. With these motives, I take the liberty to offer the accompanying treatise, which consists of the most valuable selections from the experience and labours of above twenty years.

Introductory Remarks.

The different qualities, or degrees of purity in the ingredients, as usually met with, will, while following the same prescriptions, nevertheless produce some slight variations in their effects: but the best enamel colours may always be obtained with certainty, by careful attention to the following directions.

When metals are dissolved, their solutions should always be perfectly saturated. In making the fluxes, they should be sufficiently melted in the crucibles, to flow liquid, and pour out easily.

The various qualities of the materials, or surfaces, on which painting in enamel is performed, require the colours to be adapted to the degrees of heat they will bear, or require, when burnt; and it is the general practice of the best painters in enamel, to use for the first painting and burning, colours considerably harder than those used in the second; the latter being fine soft enamels, in order to finish the work, and give it a beautiful polish. It cannot but be obvious to every person who uses enamel colours, that the hardening them, if necessary, will be effected by adding more of the colouring matters, or lessening the quantity of flux; and, if required to be more soft, or to shine more when burnt, to add a little more flux; and this is best done by a very soft flux, generally used for this purpose, such as No. 8: but when particular directions are necessary, they will be mentioned in the receipts for making the colours. It will be better to make a few ounces, at least, of each colour at a time; and they must all be ground as soon as made, in water, with a glass mullar, on a piece of plate glass; then be dried before the fire, scraped off in powder, and kept in bottles for use.

When used for painting with, they are ground in spirits of turpentine, and thickened with thick oil of turpentine; this quality, the fluid oil of turpentine acquires in three or four years..

PREPARATION OF THE MATERIALS.

Flint Powder.

Take pieces of flint, which have been burnt white at the chalk lime-burners; make them clean with hot water and a brush; then throw them, when heated red-hot, into cold water: after having thus treated them two or three times, pulverize them in a biscuit-ware mortar, with a pestle of the same material, (which will be easily effected,) and then grind them in water, on plate glass.

Where no opportunity occurs of procuring burnt flints from the lime-burners,* the common black flints, broken into pieces, made hot in boiling water, (to prevent their flying in the crucible) and treated in the same way, will produce a fine white powder.

Red Sulphate of Iron.

Sulphate of iron, otherwise called green vitriol, is to be pounded, and placed in an earthenware muffle, till the moisture is evaporated, and a gray powder left; which, put into a crucible placed in a charcoal fire, and stir with a piece of steel bar, till it is of a fine red colour; then, let it fall out of the crucible into a pan of cold water, placed under a chimney, in order to avoid the disagreeable fumes that arise; when settled at the bottom of the pan, wash it in several hot waters, and then dry it for use. The more it is burnt, the darker is the red.

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* In England, lime is frequently made by burning chalk, and the black flint which the chalk contains, is calcined in the operation; with us the calcination must be specially performed. Editor.

Brown Sulphate of Iron.

Take sulphate of iron, in lumps, and calcine it, in a red charcoal heat, till it becomes of a deep brown colour; let it cool in the crucible, and afterwards wash it repeatedly in hot water.

Black Oxide of Copper.

Take copper, and dissolve it in aqua-fortis, till the acid refuses to take up any more metal; then dilute the solution with water, and add to it some sub-carbonate of potash dissolved in water; a green precipitate will fall to the bottom of the vessel, which must be washed in several hot waters; when settled, pour off the superfluous water, and place the green deposit on a piece of blotting-paper, supported upon a piece of coarse open canvass, tied over the mouth of a large earthen pan; after the precipitate has been thus drained, it should be taken off the canvass, and made perfectly dry, by placing the paper on powdered chalk, laid in a drawer, and put before the fire. When dry, calcine it in a crucible, placed in a charcoal fire, and throw it, red-hot, into cold water; then rinse it in boiling water, and dry it at the bottom of a basin, before a fire: this is a beautiful black oxide of copper.

Green Oxide of Copper.

Take a saturated solution of copper in aqua-fortis, and precipitate it with sub-carbonate of potash; then wash it several times in boiling water, filter, and dry it.

White Oxide of Tin.

Into a small wooden box, with a sliding cover, chalked all over inside, pour melted tin from a ladle, close and shake the box, till the tin becomes finely granulated; then wash and dry it, and put it into a clean Florence oil-flask, and pour over it strong nitrous acid, which rapidly converts it into a white powder. When a sufficient quantity of this is obtained, it should be well washed in several boiling waters, be poured out into a basin, and dried before the fire;—it is then a very white oxide of tin.

Black Oxide of Cobalt.

Take good metallic cobalt,* and dissolve it to saturation in nitric acid diluted with a little water, contained in a flask, placed in a sand-bath; then pour the solution into a large basin, and having added a quantity of water to it, pour into it a solution of sub-carbonate of soda, as long as any precipitate falls down: when settled, pour off the water, wash the powder in several hot waters, filter it, and dry it. When dry, mix it in a biscuit-ware mortar, with a pestle of the same, with three times its weight of dry nitre; put the mixture into a warm crucible, and drop into it an ignited piece of charcoal: some slight explosions will then take place; and when these have ceased, make the calx red-hot: this, after being washed and dried, is the best oxide of cobalt for enamel; and is capable of forming various colours, single and compound.

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* In the choice of cobalt, that which, when dissolved in nitric acid, gives the purest and deepest red solution, generally makes the finest colours.

Fluxes.

In forming these, take great care to mix all the ingredients accurately, in a biscuit-ware mortar, with a pestle of the same material, and to powder them as finely as possible. Let the crucibles be made warm, before the fluxes are put into them, (by placing them on the fire, with the open end downwards,) which will prevent their breaking in the fire.

The best furnace for making fluxes, or for any other purpose that requires great or continued heat, is a common German stove, about 18 or 20 inches diameter, lined all round, from the grate to the top, (except the aperture at the door in front, for the occasional introduction of a muffle,) with one row of fire bricks, set with loam; the iron-pipe of the chimney projects from the back part, near the top. The top or cover of the furnace must be loose, like a lid, and be removable by handles; in the centre of it a circular hole must be made, which must also be fitted with a cover, and through which hole, the cover of the crucible may be lifted off, and its contents stirred up with a bar of steel. A small piece of fire-brick must be placed on the grate, for the crucibles to stand on; and the fuel should be either charcoal and coke mixed, or charcoal alone.

Flux, No. 1.	Red lead, ...	8	parts, by weight.
	Calcined borax,* . . .	1½	parts,
	Flint powder, ...	2	parts,
	Flint glass, ...	6	parts.
Flux, No. 2.	Flint glass, ...	10	parts,
	White arsenic, . . .	1	part,
	Nitre, ...	1	part.
Flux, No. 3.	Red lead, ...	1	part,
	Flint glass, ...	3	parts.
Flux, No. 4.	Red lead, ...	9½	parts,
	Borax, not calcined, . .	5½	parts,
	Flint glass, ...	8	parts.
Flux, No. 5.	Flint glass, ...	6	parts,
	Flux, No. 2, ...	4	parts,
	Red lead, ...	8	parts.

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* Borax, calcined to a dry white powder in a crucible, only a third part of which should be filled at once, on account of the borax swelling up so much, as it gets hot.

Flux, No. 6.	Flux, No. 2, ...	10 parts,
	Red lead, ...	4 parts,
	Flint powder, ...	1¼ parts.
Flux, No. 7.	Flux, No. 4, ...	6 parts,
	Colcothar, ...	1 part.
Flux, No. 8.	Red lead, ...	6 parts,
	Borax, not calcined, . .	4 parts,
	Flint powder, ...	2 parts.

After the fluxes have been melted, they should either be poured upon a flag stone, wetted with a sponge, or into a large pan of clean water; they should then be dried and finely powdered in a biscuit-ware mortar, for use.

[TO BE CONTINUED.]

A description of the mode of extracting the Fecula from the Potato.

Communicated from G. G. BARRELL, Esq. Consul of the United States at Malaga, to H. A. S. DEARBORN, Esq. Boston.

[CONCLUDED FROM PAGE 55.]

With a Copperplate.

Malaga, June 1st, 1827.

DEAR SIR—I wrote you a few lines some days since, and am now glad to send you the drawings of the machine for making starch, which I presume will be found perfectly clear, to any person acquainted with mechanics. It has given me some considerable trouble to procure the drawings, in the different sections in which I send them; but they are perfect, and any person whose mind has been dedicated to machinery, will, at once, understand them.

I am more and more convinced, that this article may become of most beneficial importance in the United States, where potatoes had their origin, and where industry and genius, unshackled by arbitrary power, and free from unjust and ruinous taxation, may range unrestrained through every field of science. I hope some of your friends will make the experiment without delay, as it cannot cost much, and from actual experience, I know it will succeed, and in the United States may be carried to any extent.

I have eaten the flour in a variety of shapes, for it is capable of making the finest pastry, excellent puddings, cakes of every description, gruel, broth, &c. &c. and the innocence of it, with its lightness upon the stomach, will unquestionably recommend it to our intelligent medical gentlemen, as a desirable food for weak and debilitated people.

I am unable to give you any further explanations, than what my former letter contained, respecting the machine. It is extremely simple, although on paper it appears complex; but with the aid of the letter I sent you, any person can understand it.

I feel extremely obliged to you, for the handsome manner in which you have been pleased to speak of me. It will always afford me great delight to be found serviceable, in any degree, in promoting agricultural pursuits, or any thing else which may call industry into action, for from them spring a nation's happiness: it always has been so, it is so, and so it must ever remain; and every nation on earth, which has neglected to protect them, has decayed and been ruined; but I hope in the boundless extent of our happy country, thousands of centuries may pass away, before our rulers will forget to cherish the moral and industrious pursuits of that best part of mankind—I mean the tillers of the soil.

I am, with great regard, &c.
GEO. G. BARRELL.

H. A. S. DEARBORN, ESQ.

The foregoing communication was accompanied by drawings in detail, which are now in the hands of the Editor; as the oval tub, the stand, a fly wheel, and every other part is separately represented with a minuteness not necessary to our workmen, some of them have been omitted, but enough has been engraved for all useful purposes.

Description of the plate of the Machinery for extracting the Fecula from Potatoes.

Fig. 1st. Side view elevation of the grating machine.
A, section of the hopper.
B B, cog wheels connecting the two cylinders.
C, tub containing water, in which the cylinders revolve.
D, frame to support the cylinders.
E, wheel and crank for giving motion to the cylinders.
Fig. 2. Bird's-eye view of the cylinders, frame and tub.
Fig. 3. Section of the hopper and cylinders, with the pieces to guide the potatoes.
Fig. 4. Section of the cask for washing the potatoes, which is furnished with a door on one side, in a manner similar to the common barrel churn.

On recovering Gold or Silver from old Gilt or Silvered Wood, &c.

UNTIL very lately, the small quantities of gold, or silver, that could be procured from the surfaces of wood, &c. which had been gilt, or silvered, was not thought worth the trouble of taking off; and this wood was burnt the same as any other fire-wood, without even searching in the ashes for the gold, or silver, they contained. Persons, who were aware of its value, bought this sort of wood at a very cheap rate, and burnt it by itself, on their hearths; and afterwards, with great trouble, collected from among the ashes, all the gold, &c. they contained, by the process of amalgamation. This was difficult and troublesome, on account of the vast quantity of ashes produced by the wood; and in consequence of the thick coating of carbonate of lime, with which it had been covered, this process was by no means economical.

The following simple means may be employed with profit.—First, steep the wood in boiling water, and for this purpose, a trough must be made, capable of receiving the longest pieces, and sufficiently wide to contain a number of them; then pour on the wood a quantity of boiling water sufficient to cover it, and cover the trough with a lid, which closes it as perfectly as possible, in order to retain the steam of the boiling water, as well as to keep it hot for a long time. The operation is, however, performed better, and in less time, by means of the steam of boiling water, which may be introduced into the close vessel containing the gilded wood; and to which a safety-valve is applied; or, perhaps still better, by putting it into a boiler of the form of the trough we have described, and setting it upon the fire. The boiling water, or steam, dissolves the glue, or size, which secured the leaf-gold; which on being detached falls into the water. In order to accelerate the separation of the leaves of gold, they take out the pieces or gilt wood, after they have been steeping for some time in the boiling water; they then put them into another vessel, containing a little hot water, and, with a brush wetted in this water, they brush over the gold, which easily separates and remains in the water; into which they are also careful frequently to dip the brush. The coat of size and whiting remains almost entire on the wood; and a part of the gold size only is removed with the gold, and is found mixed with it in the water.

They allow the water to remain at rest; and when the whole is precipitated, they decant the water, and evaporate the deposit to dryness. They then remove the matter found at the bottom of the vessel, powder it in a mortar, and expose it to the action of fire under a muffle, in order to burn all the glue and the greasy or oily substances which formed a part of the coating. The gold is then separated from it by amalgamation.

This process is also applicable to old gilt plaster; and whether it be taken off the wall, or remain upon it. In the latter case, the gilded part must be washed with hot water and a sponge, and be thoroughly cleaned off with a hard brush, frequently dipped in the hot water. But we must by no means neglect to collect together the mortar, &c. which falls off from the walls so treated; as it generally contains a great quantity of gold, which it is important to unite in the *washings*. By this means, we have known to be recovered more than 800 franks' worth of gold, from an old chapel which was repaired.

The same process, which is made use of to recover the gold from gilded wood or plaster, is also equally applicable to the removing of any silvering which had been laid on with silver leaves. This, although less lucrative than that of recovering gold, must nevertheless

Fig.1.

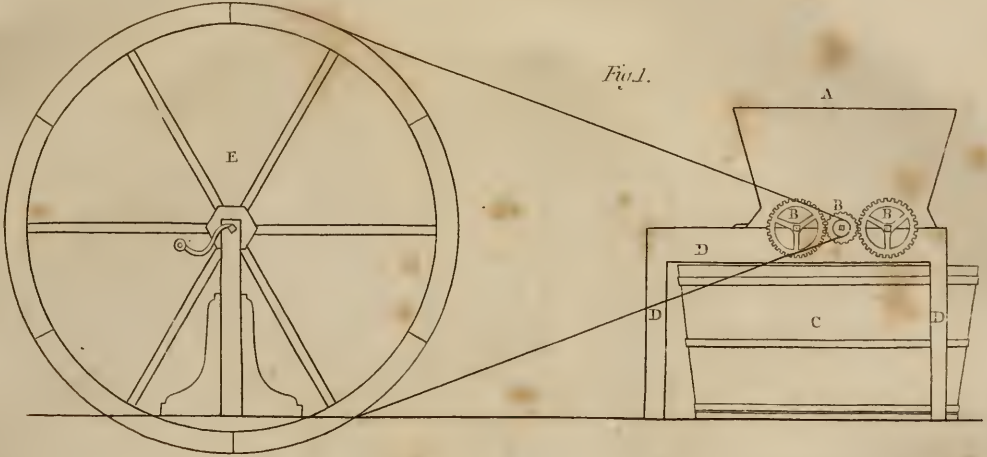


Fig.4.

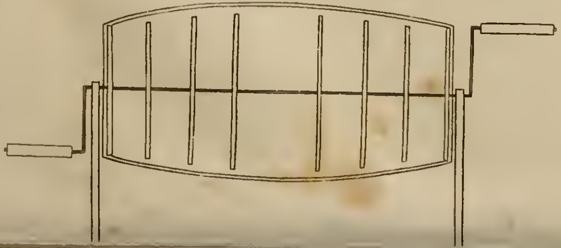


Fig.3.

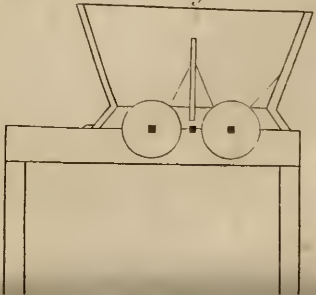
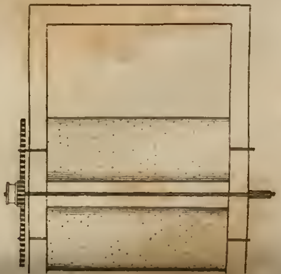


Fig.2.



not be neglected, as it produces very good results, when it is performed with dexterity and economy.

The gold and silver, also, from gold and silver lace, spun upon silk, when it is become old, may be burnt for the purpose of collecting the gold and silver. For this purpose it is made up into packets, like balls, wrapped round with iron wire, and made red-hot in a furnace; by this means the silk is reduced to ashes. When the packet is cold, they beat it in a mortar or kind of tray: the ashes all become powder, which they place upon a pasteboard, and fan or blow it gently, when the metallic parts, being the heaviest, remain, and the ashes are carried away by the wind. We must not, however, conceal the fact, that by this means, a little gold or silver will be lost; unless the ashes blown off be washed over afterwards.

There is, however, an easy means of preserving the whole of the valuable parts, if the operation is carefully performed. The lace or stuff must be cut into very small pieces, and be boiled for some time in soap-boilers' caustic lees (pot-ash, or caustic soda): these substances dissolve the silk; and the gold or silver remain pure in the liquor. The alkali must be washed off, and the deposit be afterwards *parted*, in order to separate the gold and silver.

L.

[*Dictionnaire Technologique.*

On the Preparation and Properties of a Colourless Refined Ox-Gall, for rendering Drawings in Water-Colours more bright and permanent. By P. W. Tomkins, *Esq.*

[From the Transactions of the Society for the Encouragement of Arts, Manufactures and Commerce.]

The refined ox-gall possesses all the valuable properties of ox-gall, as applicable to painting in water-colours: with the superior advantages of being deprived of all tendency to putridity, and of all colouring matters.

It combines with, and fixes all water-colours, as they are usually prepared; either by being mixed with them, or washed over them after they are laid upon the paper, &c. It renders blue, purple, red, green, and all other delicate colours, more bright and durable; and, if a small portion of it be added to any of the colours, it causes them to wash more freely and evenly, over the surface of the paper, ivory, &c.

Combined with gum-arabic, it gives depth of tint, without any unpleasant glossiness upon the surface of the drawing, prevents the gum from cracking, and the colours are so completely fixed in the paper itself, that subsequent tints can be washed over them, without any risk of their becoming foul, or forming improper combinations with the under colours.

Combined with fine lamp-black and gum-water, it forms a complete substitute for Indian ink.

If it be floated over the surface of drawings made with chalks, or black-lead pencil, it fixes them firmly; and they may then be washed over with any water-colours, previously mixed with a small portion of it; without, in the least degree, disturbing the chalks or black-lead.

For miniature-painting, being washed over the surface of the ivory, it completly removes its greasiness; and, being mixed with the colours, it causes them to float freely thereon; and tints may be laid over tints, the colours being struck into the ivory.

For transparencies, oiled paper being first washed over with the refined ox-gall, and permitted to dry, water colours, mixed with some of it, will lie freely and perfectly smooth upon it; and be so fixed, as not to wash up by the repetition of different glazings of colours over each other, thus producing depth of colour.

In short, the valuable properties this refined ox-gall possesses, make it equally applicable to historical, landscape, botanical, and natural history painting, as well as to colouring prints in general; and, by its readily combining with all the vehicles used in the preparation of water-colours, and having no colour itself; it enables the artist to paint with ease, on surfaces otherwise unfavourable; at the same time rendering the colours more bright and durable.

Many other valuable properties will, no doubt, on trial, be found in this preparation; and the result cannot fail to facilitate and improve the art of painting in water-colours: and, as the discovery of it is entirely new, it will, in all probability, be found applicable to many other useful purposes.

Process for depriving Ox-Gall of its Tendency to Putridity; and of its Colouring Matter, so detrimental to all Delicate Colours.

To a pint of fresh ox-gall, boiled and skimmed, put one ounce of alum finely powdered; continue it on the fire until combined; when cold, put it into a bottle, and cork it moderately close.

To another pint of fresh ox-gall, also boiled and skimmed, put one ounce of common salt, and continue it on the fire until combined; when cold, put it also into another bottle, and cork it moderately close.

Gall, thus prepared, will keep perfectly free from putridity, or any offensive smell, for years.

When the above preparations have stood in a room, of a moderate temperature, for about three months, they will deposit a thick sediment, crusts will form on their surfaces, they will become clear, and be fit for use in ordinary purposes; but, as they contain a large proportion of yellow colouring matter, tinging blue of a greenish hue, reds brown, and sullying purples; they are unfit for general use, in painting in water-colours.

Further Process.—The before-mentioned preparations, after standing until they are become perfectly clear, are to be decanted, and combined in equal proportions; a thick coagulum is instantly formed, of the yellow colouring matter, which precipitates; leaving a clear liquid, namely, the colourless ox-gall.

N. B. After the combination of the two first preparations, the process may be assisted, by filtering the liquid through paper. Age renders this preparation more brilliantly clear; and from it, it seems to obtain an agreeable scent: nor has it been observed to contract at any time an unpleasant smell, or to lose its useful properties.

ENGLISH PATENTS.

To JOSEPH LUCKOCK, *Gentleman, for an Improvement in the Manufacturing of Iron.*

THIS improvement consists in the application of muriate of soda, (common salt) in that part of the process of making iron, which is denominated *puddling*. The patentee states, that he "applies salt to the puddling of iron in the puddling furnace, only when pig iron, or iron of any other form, quality, or denomination is puddled therein, in the state in which it comes from the smelting furnace, commonly called in the trade the 'blast furnace,' and which when erected upon a smaller scale, is commonly called 'a cupold,' or a 'cupold furnace;' and whether such blast, or cupold furnaces, are used to melt, refine, or run out, a proportion of pig-iron, or other iron previously smelted, or made in such kind of furnaces, at the time that they are used to smelt iron-stone, or other iron ore, as is sometimes the case."

It is asserted, that by the application of the salt, malleable iron can be manufactured at less cost, than by any other known method. The salt is applied at the time the iron is fusing, or breaking down; the proportion used, is seven pounds weight of salt, to three and a half hundred weight of iron; it is applied pulverized, or in small pieces; this proportion has to be varied, according to the nature of the iron to be refined. A preference is given to those puddling furnaces which have iron, instead of clay, bottoms.

To WILLIAM JEFFERIES, *Brass Founder, for improvements in calcining, or roasting, and smelting or extracting, metals and semi-metals, from various kinds of ores, and matter containing metals and semi-metals.*

THE ore, or other matter, containing metals or semi-metals, is in the first place to be broken or crushed by stampers or rollers, until it becomes so fine as to pass a wire sieve, of eight or ten holes in the inch. After which, instead of introducing such pulverized ore or metal into a roasting oven or furnace, with a separate fire, I mix and incorporate the same with a sufficient quantity of small coal, or large coal which has been broken down, and I then introduce the mixture thus formed, into an ordinary coke oven, which has been previously heated in the ordinary way; and I cause the mixture to be coaked in the same manner as if coal alone was used; that is to say, by leaving the door, or mouth, of the coke oven open, until all the flame has worked off, and then closing it, and destroying all draught of air to prevent the further consumption of the fuel. The charge is then to be drawn in the same way as if it were common coke, and, after cooling, it is to be broken down into masses, of a proper size, for the smelting furnace, to which it is next to be carried, for the purpose of smelting out the metal, or semi-metal, from the coke with which it was before combined, and which becomes a part or the whole of the fuel to be consumed whenever coke is used in the smelting furnace, which may be of the ordinary construction for smelting or reducing the particular kind of ore under treatment. In selecting the coals for the above process, those which contain the least quantity of sulphur are to be preferred; but as the quality of coals, as well as of ores, or matters containing metals or semi-metals, varies in every district, and even in the same mine, it is utterly impossible to specify the quantity or proportion of coals and ore, or other metalliferous matter to be used; but this will be readily ascertained by any competent workman, who has been accustomed to roasting by the former, or usual processes, and cannot be described in words, because the completion of the roasting operation can only be determined upon by the appearance of the ore, and of the flame and fumes which arise from it in the furnace. The only rule which I can therefore give, is that there ought rather to be a superabundance than a deficiency of coal mixed with the ore, because by such superabundance, the full completion of the calcining or roasting process will be insured, and as nearly the whole of the coal will be converted into coke, to be afterwards used in the smelting furnace, but little of the fuel will be wasted or improvidently expended. Nevertheless, the coke oven must not be closed, even though the coals may be consuming, until it has been ascertained that the roasting has been fully accomplished, by inspection of the fumes and flames; and if, on the contrary, a sufficient quantity of coal has not been incorporated, as aforesaid, with the ore or other matter, an additional quantity of coke must afterwards be added during the operation of smelting. In the old, or accustomed, method of roasting ores, a separate furnace, or oven, and fire are always employed, and the pulverized ore requires to be constantly stirred on the hearth, to expose every part of it to the action of the fire, and prevent the top surface from running or vitrifying, and thereby protecting what is underneath it from the flame. Coke is also separately prepared for the smelting furnace, without any useful application of the heat produced in making it. But by my improvements, as above described, both these operations are combined in one, thereby producing a great saving in fuel and labour, as well as a more perfect and complete operation, because by the mixture of the pulverized ore with the small coal in the first instance, every part of that ore becomes exposed to the full action of the fire, without any chance of its running together, and without its requiring to be stirred or attended to in the oven, except only to watch for the completion of the process of roasting, as ascertained by the discontinuance of the flame, and appearance of the fumes when the coke oven is to be closed, as usual. By means of my said improvements, the usual roasting fire is completely saved, and the heat of the coke-making, employed in its stead, thus combining several operations into one, with a more beneficial result.—Enrolled, February 20, 1827.

[*Repertory of Patent Inventions.*

To William Hobson, *Gent., for an improved method of paving streets, lanes, roads, and carriage ways in general.*

Instead of picking up the ground loose (as is the practice in the present mode of paving,) ram the ground on which the paving is to be placed, well down, until it is as solid as possible, to a form corresponding with the form the surface of the paving is to take when finished. The stones should be sorted, so as to be nearly of an equal depth; mix up gravel or small fragments of stones with lime and water, into a composition or kind of coarse mortar, and lay a bed (of sufficient thickness, to allow for the irregularity of form in the bottom of the stones) of this composition, on the ground which has been previously rammed, and in this composition place the paving stones, and grout them full with finely sifted gravel or coarse sand, mixed up into a liquid state with lime and water, in the same proportions as the composition the stones are laid in. All the paving done in one day must on the same day be well rammed to an even surface, and when so done must be again grouted full, with fine gravel or coarse sand, mixed up with lime and water, as before. This must be done with each portion of paving, on the day on which the paving is executed, and this method of ramming and grouting must be followed up on each day as the paving proceeds, and when so done, it would (if practicable) be desirable that the part paved should be left without carriages being permitted to go over it for three or four days, in order to let the composition of lime and gravel, or stone, set and harden, and it will then become firm and solid, and, if the lime is of a proper quality, impervious to water. This method, if applied to paving done with pebbles or unsquared stone, will be found advantageous in a proportionate degree to paving done with squared stones. I recommend that the lime to be used in this method of paving should be stone, or gray chalk lime, as lime of that description will set and harden in water, and if of a good quality, the proportions of one measure of lime to four or five measures of gravel or small fragments of stones will be sufficient.—Enrolled, January 15, 1827. [*Ib.*

Description of the method of preparing Oil Colour Cakes, invented by Mr. George Blackman.

Take of the clearest gum mastich, reduced to fine powder, four ounces; of spirits of turpentine, one pint; mix them together in a bottle, stirring them frequently till the mastich is dissolved: if it is wanted in haste, some heat may be applied, but the solution is best when made cold. Let the colours to be made use of be the best that can be procured, taking care that, by washing, &c. they are brought to the greatest degree of fineness possible. When the colours are dry, grind them on a hard close stone, (porphyry is the best,) in spirits of turpentine, adding a small quantity of the mastich varnish. Let the colours so ground become again dry; then prepare the composition for forming them into cakes, in the following manner. Procure some of the purest and whitest spermaceti you can obtain; melt it over a gentle fire, in a clean earthen vessel; when fluid, add to it one-third of its weight of pure poppy-oil, and stir the whole well together; these things being in readiness, place the stone on which your colours were ground, on a frame or support, and, by means of a charcoal fire under it, make the stone warm; next grind your colour fine with a mullar; then, adding a sufficient quantity of the mixture of poppy-oil and spermaceti, work the whole together, with a mullar, to a proper consistence; take then a piece, of a fit size for the cake you intend to make, roll it into a ball, put it into a mould, press it, and it will be complete.

When these cakes are to be used, they must be rubbed down in poppy or other oil, or in a mixture of spirits of turpentine and oil, as may best suit the convenience or intention of the artist.

N. B. It may be proper to observe, that Mr. Blackman's colours in bladders, are prepared with a mixture of spermaceti, and differ from his cakes only in having a larger proportion of oil.

Method of making Tablets similar to the German asses-skin, from which writings, or drawings made with a pen and ink, or a pencil, may readily be rubbed off, when desired.

Take either vellum, parchment, very fine cloth, or paper, and stretch it in a frame as tight as possible. Then take twelve pounds of white-lead, and pound it very fine; add thereto one-third part of the best plaster of Paris, and one-fourth part of the best stone-lime; pound them well, mix them well together, and grind them very fine with water. Then take a new glazed vessel, and dissolve six or seven pounds of the best double size, over a fire, and mix the above ingredients in this, till it is of such a consistence as to lay on with a brush. Then lay three or four layers on the skin or cloth, as smooth as possible; observing that the skin is dry each time, before a second layer is put on. Then take the best nut or linseed-oil, and to every pound of this oil add four ounces of the best white varnish, and mix them well together. Then put on three or four layers of this oil, thus prepared, each time exposing it to the air till it is thoroughly dry: this is for the white sort. For a brown or yellow, add to every pound of the above, three or four ounces of the best stone ochre, or orpiment, or Dutch pink, and three or four ounces of litharge. These must be well ground with very old linseed-oil, and laid on, as smooth as possible, ten or twelve times; exposing it each time to the air, to be thoroughly dry, before a second layer is put on: observe you do not put it where any dust or dirt can fall upon it. It may be, by the same process, altered to any colour: as for instance; to a red, by tincturing it with vermilion, or the like; to a blue, by Prussian blue; and for a black, by pounding slate, grinding it very fine, and mixing with it as much ivory black as will turn it to a fine black colour. When it is thoroughly dry, you may write on it with a slate-pencil, or black or red lead.

On New and Improved Lutes and Cements. By Mr. JAMES DEVILLE.

THOSE manufacturers who are concerned in the use of plaster of Paris, have long been acquainted with cements of the nature of that published, as *Varley's Cement;* (Vol. I. p. 115,) the chief difference being, that *plaster of Paris*, mixed with rosin and a little bees'-wax, is employed instead of whiting, or chalk; and it is preferred, on account of its being freer from moisture than either of the other substances.

I have found the following lute or cement of great use in many cases, but particularly for closing the joints of the apparatus, during the very extensive course of experiments which I have made on the production of *oil-gas*. It is prepared as follows:

Take equal parts, by bulk, of white lead ground in linseed-oil, (as sold in the colour shops) and plaster of Paris, and well knead them together just before using the cement; and, when every thing is ready for joining, add a little water to it, more or less, as the cement is required to be thicker or thinner, and apply it immediately. In a few minutes it will *set;* and it is astonishing how very hard it becomes in the course of a few days.

This lute or cement is entirely of my own inventing, and the result of necessity, in not finding any of those usually employed to answer my purpose, and I hope that it may prove as useful to others, as I have found it to be in my own pursuits.

On an Indelible Ink, and on Bistre. By JOHN MAC CULLOCH, M. D.

THE perishable nature of our common ink is, as you well know, a frequent source of serious inconveniencies, particularly in the case of records, which it is important to preserve, if possible, for ever.

The cause is too well known to chemists to require mention; and they also know the processes that have been recommended for the restoration of manuscripts which time has rendered illegible or obscure. In a minor way, we are often teased with the obliteration of our labels or memorandums of experiments in our laboratories, where acid vapours are often let loose so as to affect the atmosphere of these places. Mere damp, I need scarcely say, has the same effect of rendering writing, made in common ink, brown and indistinct; and the same effect sometimes arises from using a bad kind of this most indispensable substance.

Numerous projects for an indelible ink, have been brought forward at different times; but none of these are effectual, except where they contain powders that are exempt from the operation of the destroying causes. The ancients used charcoal in some form, as we have attempted to use lamp-black, whether in that of Chinese ink, or in some other shape. This is indelible, as is the ink of the cuttle fish, formerly used by the ancients, and still employed as a paint by modern artists, under the name of sepia.

But there are two objections to these powders, of whatever kind, which has, hitherto, prevented them from coming into general use. It is necessary that they should be mixed with glue or gum, without which they will not adhere to the paper. These substances, as well as the powders themselves, prevent inks of this nature from flowing freely through the pen, particularly in warm rooms, or hot weather; and hence the process of writing becomes tedious and irritating. They have another fault, of no small weight, namely, that in damp situations, they become mouldy, and are at length destroyed, so as to permit the powders to get loose, and the writing to be obscured or obliterated.

The substance which I have sent you is free from all these faults at least; although it still labours under some defects, which may perhaps prevent it from being generally introduced as an ink. Yet, as it is absolutely indelible, by acids as well as by time, it is worthy of attention, particularly in the cases above alluded to, where a little imperfection will be compensated by the advantages it holds out.

It is prepared from the substance called Bistre, the nature of which I formerly investigated in a paper published in the Transactions of the Geological Society.

This substance is a compound of carbon, or charcoal, and hydrogen, principally; very analogous to the bitumens, but differing from them in some particulars, which I need not here detail. It is most conveniently procured from the destructive distillation of wood, and can now be obtained, in any quantities, from the distillers of charcoal for the gunpowder manufactories, and from the manufacturers of new vinegar.

When thus obtained, it is a liquid resembling common tar in consistence; and it is this substance which forms the beautiful brown varnish, that covers the inside of a Highland cottage; being deposited from the smoke of the peat. On being subjected to evaporation or distillation, it gives out an essential oil, either colourless or brown, according as the process is managed, analogous to naptha and to petroleum, together with acetic acid. Being thus treated, it becomes first tenacious, like soft pitch, then hard or brittle like asphaltum, with a bright, clean, conchoidal fracture. The longer the heat is continued, the more brittle it becomes, till at length it falls to powder.

The chemical change which here takes place, is that of gradually diminishing the hydrogen in the compound; and, if the process be pushed to an extremity, charcoal alone at length remains. At the same time, the colour, which was at first a yellow brown, becomes gradually darker till it settles into one that is nearly black.

In a hard state, this is the bistre of artists, although that substance is ignorantly obtained from the soot of wood, particularly beech, if possible; being generally furnished to the colourmen by the chimney-sweepers, who collect it from those places where wood is burnt. For this reason, it is a very uncertain colour as to its tone; while artists also know well that it is often glutinous and disagreeable in use; adhering and returning to the pencil, so as to render it difficult to put on clear and repeated washes.

This fault consists in the evaporation not having been carried far enough; and, from the foregoing sketch of its nature, it will also be seen that the yellowish varieties will be the most disagreeable in working. The obvious remedy for these evils, is to evaporate the oil and the acid; and that evaporation may be regulated to the greatest nicety, by adopting the liquid tar of the charcoal and vinegar distilleries. Thus it may be procured of the colour of sepia; which indeed it may be made to rival in use, as it is the same substance, considered as a chemical compound.

There is one other objection to the use of bistre, in water-colour painting, and that is its powdery nature; as it is, like other colours, merely suspended in gum. This evil is remedied by the same process which converts it into an ink.

It is soluble in the pure alkalies, both potash and soda; with which it forms a compound analogous to soap, and which is in fact, the same, very nearly, as that which common rosin forms with these, in that mixture of this substance with tallow, which produces what is called brown soap.

But it must be remarked, that the combination with potash remains liquid, if not too far evaporated, while that with soda gelatinizes, even when much water is present. The process itself is extremely simple, as it consists merely in boiling the bistre in the alkaline solutions, taking care that they are fully saturated. The degree of dilution may be regulated at any time, according to the uses for which the colour is intended.

It is not easy to give precise directions for the state in which the bistre ought to be used, for want of a scale of reference. But it cannot well be too brittle and too dark in the colour, provided it has not been so far evaporated as to destroy its solubility. To bring it to the condition of asphaltum, is, perhaps, a good general rule.

In a fluid state, this is the indelible ink in question. There is no powder here, as the bistre is in a state of solution, and it requires neither gum nor any other addition. It remains unchanged in a bottle, never depositing its colour, like common ink. It flows freely through the pen, and can be used to write as rapidly as ordinary ink. It is so incapable of change, as to resist even oxymuriatic gas: nor is it affected by any exposure to damp. I may add, that I have kept a manuscript for ten years, and more, exposed to the vapours of a large laboratory, where acid was always present, and where the paper was constantly damp, but without the slightest alteration.

Its defects are the following: It acts on the quill so as to blunt it rapidly, and to prevent the pens from giving fine hair strokes; no great evil compared to its advantages; and one which is obviated by the use of a metallic or a reed pen. It is more easily washed out by water than common ink; although it is difficult to discharge it entirely in this way, as it penetrates into the substance of the paper. This is a defect, however, to which all the powder inks are completely exposed, nor is it a trial to which manuscripts are likely to be subjected. Lastly, the colour is brown and not black. If that is a defect to the eye, it is one that arises merely from habit. It is, notwithstanding that, more visible than ordinary ink; as artists well know that brown is a more powerful colour than black, and forms a much more *forward* colour, or offers a stronger contrast with white.

Such are its advantages and disadvantages; and I still think that the balance is so much in its favour, that it ought to be adopted for all public and legal documents, which it is so essential to preserve from obliteration.

This solution is also better adapted to water-colour painting, than common ground bistre. It makes a clear wash, which is not disturbed by fresh application, and which does not deposit powder, that vice of Chinese ink, which almost renders it useless in drawing. It has also the advantage of giving a degree of *forwardness*, or intensity, in the foreground, which cannot be obtained by common bistre; and, for this purpose, the solution in soda, may conveniently be used, on account of the facility with which the paper may be loaded with it.

In terminating these remarks, I may add, that, in the use of common ink, it is an error to write with that which is blackest, although most agreeable to the eye at first. When rendered thus black, which it is by keeping, a portion of the tanno-gallate of iron has been deposited in the bottle, in consequence of the process of oxydation; so that the fluid, though darker, contains less of this salt than the pale ink which is fresh made. The more that can be applied to the paper, the longer it is likely to last; and thus, when the faint-coloured new ink is used, the greatest possible quantity is attached to it; while, in a few days, it becomes as black as if it had been used in that state from previous standing. [*Brewster's Journal.*

On the Preparation of Bistre.

This colour, used by painters in the manner of Indian ink, is prepared from wood-soot, in the following manner:—Make choice of those pieces of soot which are the hardest, and adhere most to the chimney; pulverize them, and pass the powder through a fine sieve. Throw this powder into pure water, stir it from time to time with a glass spatula, leave it at rest; and, finally, pour off the water. This water dissolves all the foreign salts. We may hasten their solution by placing the glazed earthen-vessel containing the mixture, over a fire. When other water, on being added, will no longer dissolve any salt, and it remains of the same degree of specific gravity as before it was employed, we put the sediment into a tall narrow vessel, which is to be filled with water, and agitate it with the spatula; it is then left at rest for a few minutes, in order that the coarser parts may settle. The liquid is then to be poured into another similar vessel, and the coarser parts remaining at the bottom of the former one, may be thrown away as useless.

This operation may be repeated two or three times; and the oftener, the finer will be the bistre. It must be finally left at rest for some time, and the clear water poured off from the sediment, which is to be incorporated with gum-water, and it is fit for use.

[*Dict. Tech.*

Some account of the various projects for propelling carriages by means of Steam. (From the Register of Arts;) with preliminary remarks by the Editor.

To propel carriages without the aid of animal power, has long been a favourite project, more particularly since the improvements which have been made in the steam engine, especially in the use of highly elastic steam, by which the power of the old engine has been retained, whilst a large portion of its weight has been dismissed. We have taken from the Register of Arts, a short catalogue of propositions, or trials, which have been made upon this subject; and could add largely to the list, but think it altogether unnecessary, as but few of these schemes would form an item in the history of improvements. The editor of the Register, we think, has done more than justice to the projects of our late friend, Oliver Evans, where he says, that "the public trials made in Philadelphia, of his steam-wagons, afforded demonstrative proofs to scientific men, of their economy, and of the practicability of their construction." We are not, however, disposed to complain on account of receiving too much praise, but would avoid the appearance of claiming more of it than is due to us. The fact is, that the economy and practicability of the project remain yet to be proved, both here, and in England.

We very much doubt the possibility of employing steam to propel stages, and loaded wagons, on common roads, under which denomination we include our best turnpikes. The invention by Loch and Stevenson, of supporting the boiler, and engine, on springs, consisting of pistons and cylinders operated upon by the elastic force of the steam, has been found of high importance, even on the best rail roads; as that perpetual vibration to which all parts of the engine are subjected, when fixed upon a carriage, and unsupported by springs, soon disarranges them, even upon iron ways. The observation of Mr. Hazard upon these spring pistons, in his paper, vol. 3, p. 275, we have always thought incorrect; he says, "upon close inspection, while the engine was travelling, I am convinced that they did not move." We should not expect their motion upon a rail-road, to be such, as to be *visible* to a looker on, but we apprehend that the difference between a loco-motive engine, with and without them, would be plainly *felt*, by a person riding upon them; his further objection to their utility, that, "if the boilers, with the cylinders attached to them, were raised by the small pistons from the axletrees, the connecting rods would thereby be rendered too short, to pass the dead centres," is, we apprehend, obviated, by giving an additional length to the cylinders of the engine, to allow for the rise of the boiler and engine.

That carriages can be made to run upon hard level roads, has been demonstrated, and indeed has never been doubted; but the unavoidable obstructions which must exist on the best roads, and even on the smoothest common pavements, would certainly, and rapidly, injure the machinery, whilst those elevations and depressions which must be encountered and overcome, if any good purpose is accomplished, would present difficulties which could not be obviated. An ascent which would be more than a balance for the friction of the wheels against the ground, would not be a very steep one; hence arises a difficulty not to be removed by decreasing the speed, and increasing the power; as this would make no practical difference in the friction; a rut, a gulley, a stone, or a soft place in the road, will produce all the effects of a steep ascent, with the additional one of a dangerous concussion. We have thought long, and seriously, upon this subject, and always with the result of confirming the opinion which we have expressed; and scarcely hope, that steam transportation, by land, can be extended beyond the progressive formation of rail-roads. Should occasion offer, we may hereafter urge our objections at greater length, than we at present think necessary.

Mr. Morey, whose vapour engine we formerly noticed, is now engaged in essaying its efficiency in propelling a carriage. Should it prove to be a good engine, it will be unique in point of lightness, in the room which it occupies, and in the trivial portion of material which will undergo combustion in giving motion to it. From an essay made three or four months ago, in propelling a boat on the Hudson, Mr. Morey entertains no doubt of its possessing sufficient power, either for steam boats, or loco-motive carriages. We do not know, whether this gentleman coincides with us in the opinion which we have expressed, on the propelling of carriages upon ordinary roads; nor will the correctness of this opinion affect the value of his engine, as he does not expect to accomplish that which cannot be accomplished by steam, but to arrive at the same end, without carrying an equal load of machinery and fuel. Small portions of water and of spirits of turpentine, are converted into vapour by means of a lamp, which is the only fire used; these vapours, mixed with atmospheric air, form an explosive compound, the inflammation of which, produces a vacuum, which appears to be sufficiently perfect to secure a powerful re-action, from atmospheric pressure.

EDITOR.

Steam-Carriages.—As the subject of steam-carriages is of great public interest at the present moment, and as a considerable degree of misunderstanding prevails, respecting the origin and progress of this branch of practical mechanics, we propose, to give a slight chronological account of the inventions of those projectors, who have been, or are now, engaged in attempting to accomplish this important end.

In 1772, the late Oliver Evans, of Philadelphia, while apprentice to a wheelwright, first conceived the idea of propelling land-carriages without employing animal power. All the modes that have since been tried, such as the wind, treadles with ratchet wheels, cranks, &c., to be worked by men, were considered too futile by him to deserve a trial; by some subsequent experiment with steam, by a high pressure, he was convinced that he had discovered a suitable power; upon which he renewed his studies with increased ardour, and soon declared that he could make steam-wagons. This assertion drew upon him the ridicule of his associates; but, convinced of its feasibility himself, he maintained his position, and confirmed it by numerous experiments.

In 1786, he petitioned the legislature of Pennsylvania, for the exclusive right to use his improvements in the steam engine, in the construction of steam mills and steam wagons; the committee to whom the subject was referred, considered him insane, as regarded the latter proposition, and granted only the former. A similar petition to the state of Maryland was, however, successful in both points, owing to the good sense of the members of the committee, who urged that the grant could injure no one—that it might produce something good. These reasons obtained a grant to Oliver Evans, in May, 1787, for fourteen years. An interesting account of this ingenious man's improvements in the steam engine, and his experiments with steam wagons, is given in "Galloway's History of the Steam Engine," pp. 94. 101.

The public mind, both in England and America, was not at that time adapted for the encouragement of such an undertaking, and Mr. Evans' pecuniary resources were inadequate to overcome the obstacles which he met with in his proceedings, although the public trials made in Philadelphia of his steam wagons afforded demonstrative proofs to scientific men of their economy, and of the practicability of their construction; but no capitalist was found disposed to advance the requisite sum for carrying the proposition into full effect. Mr. Evans being at the same time successful in the application of his admirable high pressure steam engine to propel boats, mills, &c., the steam wagons were laid aside for a more convenient and propitious opportunity.

In 1802, Messrs. Trevithick and Vivian proposed to adapt their high pressure engine to propel carriages on the common road; the form of their carriage resembled the common stage coach. The cylinder and boiler in a horizontal position were placed behind the carriage, and made to vibrate on pivots, so as to follow the revolution of the crank.

In 1804, Messrs. Trevithick and Vivian's loco-motive engine was successfully applied to the Merthyr Tydvil rail-road, South Wales.

In 1811, some improvements upon Trevithick and Vivian's plans were introduced by Mr. Blenkinsopp, of Middleton Colliery, near Leeds.

In 1813, Mr. William Brunton, of Butterly iron works, took out a patent for a loco-motive machine, in which were first introduced the propellers, in imitation of the action of horses' legs, and feet. This contrivance was materially improved upon by Mr. David Gordon, and was subsequently adopted by Mr. Gurney, with but little variation.

In 1814, Mr. Thomas Tudal, of York, took out patents for improved steam-carriages.

In 1814, Messrs. Dodd and Stephenson, introduced their patent improvements, which resembled Trevithick's, with respect to the contact of surfaces to obtain propulsion.

In 1816, Messrs. Loch and Stevenson took out patents for further improvements, which consisted in a mode of supporting the weight of the engine and machinery supportable on pistons, moveable in vertical cylinders, filled with steam, which acted as springs possessing the nicest elasticity.

In 1821, Mr. Julius Griffith, of Brompton, Middlesex, patented a new and very ingenious arrangement for a loco-motive carriage; it was the first, in which the engine and machinery were placed upon springs.

In 1823, Mr. Samuel Brown applied his gas vacuum engine to the propulsion of a carriage, which has made several public experiments.

In the same year, Mr. James, sen. patented some new contrivances, applied to loco-motive carriages, or rail-ways.

In 1824, Mr. W. H. James introduced some valuable improvements, and subsequently an excellent boiler and propelling machinery.

In the same year, Mr. David Gordon, patented his new arrangements for a steam-carriage.

In 1825, Messrs. Burstall and Hill, of Southwark, produced their first loco-motive carriage.

In the same year, Major M'Curdy applied his steam apparatus to a carriage for the common road.

In 1826, Mr. Gurney commenced the application of his patent steam generating apparatus to loco-motive purposes.

In the same year, Messrs. Burstall and Hill, took out their second patent for further improvements; a carriage, according to which, is built, and is undergoing alterations from time to time, as suggested by repeated experiments.

In the present year, Mr. James Neville, of Shad, Thames, has undertaken, and patented, a peculiar construction of loco-motive steam-carriages.

Also this year, Mr. Frederick Andrews, of Stanford Rivers, Essex, a new patent invention for a similar object.

There are now building, or altering, in London only, the following steam-carriages, of different constructions:—Gordon's, James's, Gurney's, Burstall's, Brown's, Hancock's, (of Stratford, not mentioned before,) also Beale's, (Commercial road, not mentioned before,) besides several others, respecting which our information must at present remain private.

It is likewise to be observed, that the preceding list of loco-motive projectors, falls far short of the whole of them; they include only such as occurred to our memory, or, were of easy reference to us. Our readers may be assured of our giving them the earliest intelligence, of whatever experiments of importance, may take place, among those horseless charioteers, and that their vehicles shall be all faithfully described and registered by us. [*Register of Arts.*

On the blowing of Air into furnaces, by a fall of water. By the late WILLIAM LEWIS, M. D.*

THE earliest method of animating the large fires of the furnaces for melting ores, appears to have been by exposing them to the wind. Such was the practice of the Indians of Peru before the arrival of the Spaniards in that country. Alonso Barba relates, that their furnaces, called guairas, were built on eminences, where the air was freest; that they were perforated on all sides with holes, through which the air was driven in, when the wind blew, which was the only time the work could be carried on; that under each hole was made a projection of the stone work on the outside, and that on these projections were laid burning coals to heat the air, before its entrance into the furnace. Some authors speak of thousands of these guairas burning at once, on the sides and tops of the hills of Potosi.

I have been informed, that several remains of a like rude process are to be seen in some parts of our own country. The old bloomery-hearths, as they are called, for running down of iron ore, are all on the tops of hills; a situation which can scarcely be supposed to have been chosen on any other account than for the conveniency of the wind, being in other respects extremely incommodious.

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* To this account, we shall hereafter add the more recent plans for obtaining the same end. EDITOR.

The gradual succession of bellows, to this precarious and insufficient way of supplying air, and the gradual improvements made in the structure and manner of working of the bellows, cannot, perhaps, be traced. It appears, that at some of our iron furnaces, and others, the bellows were formerly moved by a handle, as those of the smith's forge, or by the pressure of the foot upon a treadle, or by other means requiring the strength of men: and that, since the force of water has been called in aid, to move them, the quantity of ore run down has not only been far greater, but the separation of the metal more complete; insomuch, that great part of the iron now (1763) prepared at some considerable works, particularly in the county of Gloucester, is no other than what had been formerly left in the slags or cinders for want of sufficient force of air.

The bellows used at our furnaces are composed of two boards joined by leather, nearly in the same manner as the common bellows. A cheaper kind of bellows, made entirely of wood, was introduced at the furnaces of the Hartz forest in Germany, according to Schluter, about the year 1620, and has since been received in Sweden, and some parts of France. It consists of two long boxes of the same figure with the smith's bellows, one of which drops over the other, and is of such a depth, that when raised upon a hinge, as high as it is intended to be, it no where comes entirely off: the air enters by a valve, as in other bellows, and is forced out by pressing down the upper box: along the edges of the lower, or inner box, are placed laths, which slide horizontally in grooves, and to which are fitted springs, capable of pressing them an inch or two beyond the box, so as to form a ledge, of variable width, which always accommodates itself to the outer box, and in great measure prevents the air from escaping between them.

Though the wooden bellows have an advantage above the leather ones of being less expensive and more durable, they have considerable defects; for it is scarcely possible to make the junctures so tight, as to allow no exit to the compressed air, and the friction must necessarily be very great. Some have therefore had recourse to water, for doing the office of the under board of the bellows. A bellows on this principle, is described in the Philosophical Transactions, and I have been favoured with descriptions and drawings of two singular ones, now used at some of the iron works in this kingdom, one for the finery, and the other for a large iron furnace, in which the fuel is coke, and which requires the greatest force of air of any known kind of furnace.

There is another method of applying water, so as to produce a strong blast, by means more simple than any of the foregoing, and at little expense. A stream of water, falling through a pipe, in certain circumstances, carries air down with it: and this air afterwards disengaged from the water at the bottom, may be so collected, as to have no other vent, than a pipe which shall carry it to the furnace.

Machines constructed on this foundation, though little known among us, are used in different countries, instead of bellows, for animating the large furnaces. But their structure and principles of action have hitherto so little undergone a scientific examination, that those which have been found to answer the best, may be presumed to owe their excellence merely to chance, and that the workmen have often laid the greatest stress upon the proportions of parts which are inessential. These machines are, doubtless, capable of being much improved, so as to produce greater effects with a less quantity, and, what is of more consequence, with a less fall of water; and principles, may, doubtless, be discovered, by which their structure may be regulated and their power ascertained.

The importance of procuring commodious and cheap means of supplying the vast quantities of air, which the smelting furnaces require, induced me to examine the several accounts that have been published *of these simple substitutes for bellows:* and to make sundry experiments for bringing them nearer to perfection, and for establishing their laws of action.

An account of the principal Machines for blowing Air into Furnaces by a Fall of Water.

I. *A simple pipe.*—The first account I have met with of a machine for propelling air into furnaces by a fall of water, carrying down air with it, is of one at the copper or brass furnaces at Tivoli, near Rome, of which a description and figure are given in the third number of the Philosophical Transactions, and in the *Journal des Scavans*, for the year 1666.

A square wooden pipe, of considerable width, and open at both ends, is placed upright. A stream of water runs in at the top, and is discharged at the bottom; and at about the middle of the height of the pipe, a smaller horizontal one is inserted, which reaches to the furnace, and is said to convey to it a strong blast of air.

From so imperfect a description, we can learn little of the nature of the machine, or of the manner in which the blast is produced. It may be presumed, that the water, running forcibly against the side of the pipe, as it appears to do in the figure, is, in great part, dashed into drops; the intervals between which being filled by air, this air is successively pushed down, by the drops which follow, and afterwards escapes, as soon as it meets with a vent. There seems, however, to be some inaccuracy in the description, or some essential part omitted; for in such trials as I have made, when air thus conveyed into a perpendicular pipe along with running water, was discharged by a lateral aperture, part of the water always accompanied it in a stream; and more of the water seemed to issue out, in proportion as the quantity of air introduced was the greater.

II. *A pipe, with air-holes, inserted into an air-vessel.*—M. Belidor, in his *Architecture Hydraulique*, gives a more particular description of a water machine, used in some parts of France: he says there are four or five forges on the river Isere, between Romans and Grenoble, which have no other bellows.

The stream is divided into two channels, and each division falls into an upright pipe, ten or twelve feet high. Near the tops of the pipes are several holes, made sloping downwards from the outside to the inside: through these holes air enters, and is carried down by the water; though the experiments in the following section will show that the quantity of air thus introduced, is not so great, as in the dispositions mentioned hereafter.

The essential difference of this instrument from the foregoing, consists in its having an air vessel, or reservoir for the air, at the bottom. An oval vessel near seven feet high, and three or four feet wide, is inverted, and its lower edge let into the ground, five or six inches. The lower ends of the two upright pipes enter into the top of the tub, and under each pipe is a kind of small stool, on which the water falls. The water, loaded with air, dashing against the stools with great velocity, rebounds, and its air is disengaged: a pipe communicating with the top of the tub, carries the air to the furnace, while the water runs out at a hole in the lower part; a sufficient height of water being kept in the tub, above this hole, to prevent any air from escaping by it.

III. *A funnel and pipe, without air-holes, inserted into an air-vessel.*—M. Marriotte, in his treatise *Du Mouvement des Eaux*, gives an account of another contrivance for blowing fire by a fall of water, which, Belidor says from the information of a friend, who travelled in Italy, is used in the Tiburtine mountain, near Rome, and near Salan, on the Lac de Guarde.

A wooden or tin pipe, fourteen or fifteen feet high, and one foot in diameter, has its lower end fixed into an air vessel, or inverted tub, as in the preceding section, from the one side of which a blast-pipe goes tapering to the furnace.

The upper end of the large upright pipe is contracted to an aperture of three or four inches, into which is fitted a funnel, whose neck exactly fills it. Into the funnel there falls a stream of water, from the height of ten, fifteen or twenty feet; which we may presume to be dashed into drops in its fall, and to push down air before it, on the same principle as in the machine of Tivoli, already mentioned.

This instrument promises to be more effectual than either of the preceding; though in this country it can be of little use, so high a fall of water being rarely to be procured, at least in those places where smelting furnaces are established.

IV. *A funnel and pipe, with air-holes, inserted into an air-vessel. —At Lead-hills, in Scotland.*—In No. 576 of the Philosophical Transactions, in the year 1745, Mr. Stirling describes a machine, erected in Scotland, for blowing air into furnaces in which lead ores are smelted; and for conveying fresh air into the works, so as to save the trouble and expense of the double drifts and shafts, and the cutting of communications between them.

A stream of water runs into a wooden funnel, so as to keep it always nearly full: the height of the funnel is five feet, and the diameter of its throat three inches and a half. The neck of the funnel is inserted into an upright pipe, whose diameter is five inches and a half, and its length fourteen, fifteen, or sixteen feet: immediately under the throat of the funnel four air-holes are made in the pipe, at equal distances round it, about an inch and a half wide, sloping downwards from the outside to the inside.

The lower end of the pipe enters into a wooden tub, close at top, but without a bottom, six feet high and five and a half feet wide, sunk into a pit dug in the ground, and well rammed about with clay: in the middle of the tub, directly under the pipe, is a flat stone about two feet high, for the water to fall upon; and into the top of the tub is fixed a pipe for carrying off the air, communicating at the farther end with an iron one, which enters the furnace : for regulating the blast, a small hole is made in some convenient part of the pipe, which is stopped with a pin, or opened, according as the blast is required to be more or less strong. The hole in the lower part of the tub, by which the waste water passes out, is about five inches square; and one side of the pit, where the water runs off, is a little lower than the surface of the stone, so that the water can never rise high enough in the tub to cover the stone; though it is supposed to continue always a considerable height above the top of the hole.

Though this machine is said, in the Transactions, to be sufficient for the smelting of harder ore than any in Leadhills, where it was erected, I have been informed, by a person concerned in those works, that it has since been found not to answer so well as could be wished; and that accordingly it has been laid aside, and its place supplied by the bellows.

[TO BE CONTINUED.]

ACTIVE AND PASSIVE STRENGTH.

Active Strength, or Animal Energy, as of Men, Horses, &c.

[From Gregory's Mathematics for Practical Men.]

CONTINUED FROM PAGE 130.

8. In the first volume of my *Mechanics*, I stated the average force of a man at rest to be 70 lbs., and his utmost walking velocity, when unloaded, to be about 6 feet per second; and thence inferred that a man would produce the greatest momentum, when drawing $31\frac{1}{9}$ lbs. along a horizontal plane, with a velocity of 2 feet per second. But that is not the most advantageous way of applying human strength.

9. Dr. Desaguliers asserts, that a man can raise of water, or any other weight, about 550 lbs., or one hogshead, (weight of the vessel included,) 10 feet high in a minute; this statement, though he says it will hold good for 6 hours, appears from his own facts to be too high; and is certainly such as could not be continued one day after another. Mr. Smeaton considers this work as the effort of haste or distress; and reports that 6 good English labourers will be required, to raise 21141 cubic feet of sea-water to the height of four feet, in

four hours: in this case the men will raise a very little more than 6 cubic feet of fresh water each to the height of 10 feet in a minute. Now the hogshead containing about $8\frac{1}{2}$ cubic feet, Smeaton's allowance of work, proves less than that of Desaguliers', in the ratio of 6 to $8\frac{1}{2}$, or 3 to $4\frac{1}{4}$. And as his good English labourers who can work at this rate are estimated by him, to be equal to a double set of common men picked up at random, it seems proper to state that, with the probabilities of voluntary interruption, and other incidents, a man's work for several successive days ought not to be valued at more than half a hogshead raised 10 feet high in a minute. Smeaton likewise states that two ordinary horses will do the work in three hours and twenty minutes, which amounts to little more than two hogsheads and a half raised 10 feet high in a minute. So that, if these statements be accurate, one horse will do the work of five men.

Mr. Emerson affirms, that a man of ordinary strength, turning a roller by the handle, can act for a whole day against a resistance equal to 30 lbs. weight; and if he works 10 hours a day, he will raise a weight of 30 lbs. through $3\frac{1}{2}$ feet in a second of time; or, if the weight be greater, he will raise it to a proportionally less height. If two men work at a windlass, or roller, they can more easily draw up 70 lbs. than one man can 30 lbs.; provided the elbow of one of the handles be at right angles to that of the other. Men used to bear loads, such as porters, will carry from 150 lbs. to 200 or 250 lbs., according to their strength. A man cannot well draw more than 70 lbs. or 80 lbs. horizontally: and he cannot thrust with a greater force, acting horizontally at the height of his shoulders, than 27 or 30 lbs. But one of the most advantageous ways, in which a man can exert his force, is to sit and pull towards him, nearly horizontally, as in the action of rowing.

M. Coulomb communicated to the French National Institute, the results of various experiments on the quantity of action which men can afford by their daily work, according to the different manners in which they employ their strength. In the first place he examined the quantity of action which men can produce when, during a day, they mount a set of steps or stairs, either with or without a burthen. He found that the quanity of action of a man who mounts without a burthen, having only his own body to raise, is double that of a man loaded with a weight of 68 kilogrammes, or 150 lbs. avoirdupois, both continuing at work for a day. Hence it appears how much, with equal fatigue and time, the total or absolute effort may obtain different value by varying the combinations of effort and velocity.

But the word *effect* here denotes the total quantity of labour employed to raise, not only the burthen, but the man himself; and as Coulomb observes, what is of the greatest importance to consider is the *useful effect*, that is to say, the total effect, deducting the value which represents the transference of the weight of the man's body. This total effect is the greatest possible, when the man ascends without a burthen; but the *useful* effect is then nothing: it is also nothing if the man be so much loaded as to be scarcely capable of moving: and consequently, there exists between these two limits a value of the load such that the useful effect is a maximum. M. Coulomb supposes that the loss of quantity of action is proportional to the load, (an hypothesis which experience confirms,) whence he obtains an equation which, treated according to the rules of maxima and minima, gives 53 kilogrammes, (117 lbs. avoird.) for the weight with which the man ought to be loaded, in order to produce during one day, by ascending stairs, the greatest useful effect: the quantity of action which results from this determination, has for its value, 56 kilogrammes, (123½ lbs. avoird.) raised through one kilometer, or nearly 1094 yards. But this method of working, is attended with a loss of three-fourths of the total action of men, and consequently, costs four times as much as work in which, after having mounted a set of steps without any burthen, the man should suffer himself to fall by any means, so as to raise a weight nearly equal to that of his own body.

From an examination of the work of men walking on a horizontal path, with or without a load, M. Coulomb concludes that the greatest quantity of action takes place when the men walk being loaded: and is to that of men walking under a load of 58 kilogrammes, (128 lbs. avoird.) nearly as 7 to 4. The weight which a man ought to carry in order to produce the greatest *useful effect*, namely, that effect in which the quantity of action relative to the carrying his own weight is deducted from the total effect, is 50·4 kilogrammes, or 111·18 lbs. avoirdupois.

There is a particular case which always obtains with respect to burthens carried in towns, viz. that in which the men, after having carried their load, return unloaded for a new burthen. The weight they should carry in this case, to produce the greatest effect, is 61·25 kilogrammes. (135⅛ lbs. avoird.) The quantity of useful action in this case, compared with that of a man, who walks freely and without a load, is nearly as 1 to 5, or in other words, he employs to pure loss, ⅘ of his power. By causing a man to mount a set of steps freely and without burthen, his quantity of action is at least double of what he affords in any other method of employing his strength.

When men labour in cultivating the ground, the whole quantity afforded by one, during a day, amounts to 100 kilogrammes elevated to one kilometer, that is, 220·6 lbs. raised 1094 yards. M. Coulomb comparing this work with that of men employed to carry burthens up an ascent of steps, or at the pile-engine, finds a loss of about $\frac{1}{20}$ part only of the quantity of action, which may be neglected in researches of this kind.

In estimating mean results, we should not determine from experiments of short duration, nor should we make any deductions from the exertions of men of more than ordinary strength. The mean results have likewise a relation to climate. "I have caused," says M. Coulomb, "extensive works to be executed by the troops at Martinico, where the thermometer (of Reaumur) is seldom lower than 20° (77° of Fahrenheit). I have executed works of the same kind by the troops in France: and I can affirm that under the fourteenth degree of latitude, where men are almost always covered with perspiration, they are not capable of performing half the work they could perform in our climate."

10. Entirely according with these are the experiments of Regnier, by means of a Dynamometer, the results of which, not only establish the superiority of civilized men over savages, but that of the Englishman over the Frenchman. The following is reduced from one of Regnier's tables of mean results.

STRENGTH.	With the hands.		With the reins.	
	lbs.	oz.	lbs.	oz.
Savages, of Van Dieman's Land	30	6	0	0
——— New Holland	51	8	14	8
——— Timor	58	7	16	2
Civilized men: French	69	2	22	1
——— English	71	4	23	8

11. A porter in London is accustomed to carry a burthen of 200 lbs., at the rate of three miles an hour: and a couple of chairmen continue at the pace of four miles an hour, under a load of 300 lbs. Yet these exertions, Professor Leslie remarks, are greatly inferior to the subsultory labour performed by porters in Turkey, the Levant, and generally on the shores of the Mediterranean. At Constantinople, an Albanian porter will carry 800 or 900 lbs. on his back, stooping forward, and assisting his steps by a short staff. Such loads, however, are carried for very short intervals. At Marseilles, it is affirmed that four porters carry the immense load of nearly two tons, by means of soft hods passing over their heads, and resting on their shoulders, with the ends of poles, from which the goods are suspended.

12. With regard to the magnitude of the comparative efforts of man in different employments, the late Mr. Robertson Buchanan ascertained, that in working a pump, in turning a winch, in ringing a bell, and rowing a boat, the Dynamic results are as the numbers 100, 167, 227, and 248.

According to the interesting experiments described in M. Hachette's *Traité des Machines*, the dynamic unit being *the weight of a cubic metre of water raised to the height of one metre*, [that is, 2208 lbs. avoird., or 4 hogsheads raised to the height of 3·281 feet, or 1·3124 hogsheads to the height of 10 feet,] we have the following measures, at a medium, of the daily actions of men.

	Dyn. Unit.
1. A man marching $7\frac{1}{2}$ hours on a slope of 7 degrees, with a load of from 15 to 18 lbs.	225
2. Marching in a mountainous country without load	140
3. Carrier of wood up a ladder, his weight 123, his load 117 lbs.	109

	Dyn. Unit.
4. Carrier of peat up steps, his own weight comprised, 112 to	120
5. Man working at the cord of a pulley to raise the ram of a pile engine: three examples	75 40 48
6. A man drawing water from a well by means of a cord	71
7. Man working at a capstan	116
8. Man working at a capstan to raise water, mean of 24	110

The unit of transport being the weight of a cubic metre of water, carried a metre (2208 lbs. 3·281 feet) upon a horizontal road, we have for the daily action.

	Dyn. Unit.
1. A man travelling without load on a flat road, his weight 154 lbs., his journey 31¼ miles	3500
2. A soldier, carrying from 44 to 55 lbs., travelling 12½ miles, 1800 to	1900
3. Ditto, a forced march of 25 miles	2800
4. A French coal-porter, weight of the man not included, 792 to	880
5. Porter with wheel-barrow, weight of the man not included	1015
6. Porters with a sledge	627
7. A man drawing a boat on a canal; 110310 lbs. conveyed 6⅞ miles	550000

14. Mr. *B. Bevan*, an able engineer, has made experiments on the application of human energy to the use of augers, gimblets, screw-drivers, &c. He has presented to the public, the following list, as a specimen; premising that many ordinary operations are performed in a short space of time, and may therefore be done by greater exertion than if a longer time was necessary. Thus a person, for a short time, is able to use a tool, or instrument, called

	lbs.
A drawing-knife, with a force of	100
An auger, with two hands	100
A screw-driver, one hand	84
A common bench vice handle	72
A chisel and awl, vertical pressure	72
A windlass, handle revolving	60
Pincers and pliers, compression	60
A hand-plane, horizontally	50
A hand or thumb-vice	45
A hand-saw	36
A stock-bit, revolving	16
Small screw-drivers, or twisting by the thumb and fore-finger, only	14

15. M. Morisot, informs us that the time employed by a French stone mason's sawyer, to make a section of a square toise, (40·89 sq. feet Eng.) in different stones, is as follows: viz.

	hours.
Calcareous stone, equal grain, spec. grav. 2200	45
——— hard, spec. grav. 2300	62
Liais, ditto, hard, fine grain, spec. grav. 2400	67
Pyrenean alabaster, the softest of the marbles	56
Normandy granite	504
Granite from Vosges	700
Red and green porphyry	1177

The workmen ordinarily made 50 oscillations in a minute; each stroke about 15¾ inches.

16. Hassenfratz assigns 13 kilogrammes as the mean effort of such a man; but M. Navier, in his new edition of *Belidor*, *Architecture Hydraulique*, regards this estimate as too high. If this were correct, the daily quantity of action of the sawyer, would be equivalent to 376 kilogrammes, elevated to a kilometre, (818 lbs. raised ⅝ of a mile,) a quantity more than triple that of a man working at a winch. M. Navier gives, as a more correct measure of this labour for 12 hours, 188 kilogrammes raised a kilometre: half the former measure. But all this is probably very vague.

[TO BE CONTINUED.]

Account of some of the Processes in the Manufacture of Edge Tools, and other Steel Instruments. By SAMUEL PARKES, F. L. S. &c. [*Abstracted from Chemical Essays.*]

IN the manufacture of edge tools, the process which immediately succeeds the forging, is that of *hardening*. All these cutting instruments are therefore fashioned when the metal is in its originally soft state; and when they have attained the intended forms, they are heated afresh, to a particular temperature, suitable to the article. When they have acquired that degree of heat, they are instantly plunged into cold water, which gives them great hardness, and renders them capable of cutting soft iron, or even steel.

The best cutlers have ascertained, that it is always desirable not to give an instrument a greater degree of heat, by this operation, than is absolutely necessary; but this will be better understood as we proceed in describing that process.

Nothing augments the hardness of steel but increasing the *coldness* of the water; and hence some have had recourse to the solution of salts in the water to be employed in hardening. A stream of running water will make steel harder than *still* water, as fresh portions of the same fluid are incessantly presented to the heated metal. Some cutlers have assured me that they can make the best instruments, when they employ urine in the process of hardening. May not this be attributable to the phosphoric salts contained therein, as it has been demonstrated that phosphorus is one of the component parts of steel?

Experience has proved, that instruments which are the hardest, acquire the keenest edge, and are the most capable of cutting; but then a great degree of hardness always occasions the metal to be brittle; and when the edge is very fine, such instruments are useless for dividing hard substances, because the sharp part is not tenacious enough to endure the operation without snapping asunder. It is necessary, therefore, to be content with less hardness, in order to obtain the requisite tenacity, and this is effected by the operation called *tempering*.

Hence, when an instrument has been properly hardened, it must be softened again in some measure, or to that degree, which is thought to be most suitable for that particular purpose for which it is intended. To effect this, it is heated again only to a certain point, which is usually determined by the colour which the metal assumes, and then it is instantly plunged into cold water. This is called letting it down to the proper temper.

In France it has been the practice, in hardening small steel instruments, to cover them with soft soap, and then to roll them in common salt. This treatment prevents the articles from scaling, and does not prevent the hardening. The salt fluxes to a glass which covers the metal and protects it from oxidizement.

Pliny informs us, that in his time, the more delicate iron instruments were steeped in oil to quench them, lest they should grow too hard and brittle with water. On the contrary, Jonston says, that "if iron be plunged in vinegar it will endure no hammering, but will sooner break than draw." The Lacedæmonians, who made their coins of iron rods, were used to steep them in vinegar when red hot, that, being thus rendered brittle, they might never be put to any other use.

Here I should be guilty of great injustice, if I were to omit to notice the improvements in softening and hardening iron and steel, which have been discovered by Messrs. Perkins and Fairman, of London, and employed by them in preparing steel plates on which they engrave bankers' notes.

The usual mode of ascertaining the temperature to which any edge tool has arrived, is by attending during the operation to the shades of *colour*, which, as the metal becomes more and more heated, the bright parts assume in rotation, and then when it has acquired that particular hue which may be desired, removing it from the fire into water. But the nature of the operation is such, that this must always be attended with some uncertainty, especially as different tools require different management in the process, and it is often a very uncertain task to give the same temperature to every part of the same instrument.

It was on account of these, and some other difficulties, which the makers of edge tools constantly labour under, that I was induced to turn my attention to the subject, trusting that I should be enabled to suggest to the unscientific cutler, some improvement in this most important, though very uncertain branch of the art. But, in order that the reader may be better able to appreciate what I have to propose, I shall first show what particular colours are usually required for the tempering of a few of the instruments which are most in demand, and then explain some of the methods now practised for the attainment of some peculiar purposes.

In tempering edge tools, the first colour, which appears at 430° of Fahrenheit, is very pale and only a little inclining to the *yellow;* this is the temperature at which lancets are usually tempered.

At a little higher temperature, say 450°, the pale *straw* colour appears, which is a heat suitable for the best razors and most of the surgical instruments. Then comes the *full yellow*, at 470°, which is proper for common razors, penknives, and some other implements of surgery.

By increasing the temperature to 490°, the *brown* colour will be produced, which is generally looked for by those who have to temper garden-hoes,* small shears, and scissors, and all those chisels which are designed for cutting *cold* iron. Then at 510° comes the brown, dappled with *purple spots*, which shows the proper heat for tempering axes, firmer chisels, plane-irons, and pocket-knives. The next colour in succession is the *purple*, at 530°, the heat at which table-knives and large shears are usually tempered. The next is the *bright blue*, at 550°, which will give a proper temper to swords, watch-springs, springs for trusses, bell-springs, &c. Then comes the *full blue*, at 560°, which being the highest spring temper, is usually employed for small fine saws, daggers, augers, &c. This is the proper heat, also, for tempering most of those instruments which require to be elastic. The last degree in succession is the *dark blue*, approaching to black, which shows itself at 600°, and is the softest of all the gradations of temper, when the metal becomes suitable to few other instruments than hand and pit saws, which are necessarily made very soft in the first instance, that the workmen may be able to file them up, and set them, whenever they find occasion for it, without being obliged to soften them every time that operation is to be performed. This great heat is likewise employed in tempering some particular kinds of springs.

Some curious facts respecting the properties of *blued steel*, are related by Mr. Nicholson, on the testimony of Mr. Stodart, who says, "that he has found the spring, or elasticity, of the steel to be greatly impaired by taking off the blue with sand-paper, or otherwise; and, what is still more striking, that it may be restored again by the bluing process, without any previous hardening, or other additional treatment."

Extraordinary as these facts may appear, they have been fully confirmed by a manufacturer of Sheffield, who signs T. B. (probably Mr. Boulsover) and who writes thus:—"I took," says he, "a steel plate 30 inches long, 12 broad, and about ,04 thick; I hardened it in a composition of oil and tallow, and afterwards tempered it down to a spring temper; it was now so elastic as to recover its position after being bended—by hammering it to set it straight, it lost a part of its elasticity; after being ground in the same manner as a saw, the elasticity became still less, having nearly returned to the same state as before hardened:—it was then very uniformly heated until it became blue; it now recovered the whole of its elasticity:—after being glazed bright upon a glazer coated with emery, the elasticity was found to be impaired, but in a less degree than when it was ground; the same effect was also produced by rubbing with emery or sand-paper, and also by burnishing; invariably the elasticity was recovered by bluing, and hence this is always the last operation in the manufacture of elastic steel plate.

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* Some workmen prefer 460°, or 470°, for garden-hoes, and such like implements.

Every maker of edge tools well knows that their temper is indicated by the colour which they assume; thus by observing the progress of the colour, he is guided in operating on the different kinds of instruments, experience alone being the rule in these cases; but in order to obtain the most favourable results in some instances of nicety, there are other minutiæ which require much care and observation.

[TO BE CONTINUED.]

On some properties of Iron in its different states, and under particular circumstances. By M. Pajot Descharmes.

Translated for this Journal.

MORTAR, OR CEMENT FOR STONE.

There is a species of tritoxide of iron, which is of a violet brown colour, impalpable, and of a brilliant micaceous appearance, which results from the decomposition of muriate of soda, (common salt,) by the action of sulphate of iron, (copperas,) assisted by heat. If this be mixed with quick-lime, and sand, with a sufficient quantity of common water, to bring the whole to a pasty consistence, on applying the composition to two stones which it is wished to unite, this mortar quickly becomes so hard and strong, that the two pieces will be so firmly cemented, as to appear to form but one body.

Remarks by the Editor.—To obtain the oxide (rust) of iron for the above purpose, all that is necessary, is to dissolve about equal quantities of common salt, and copperas, in separate portions of water, and to pour them together at a boiling heat, when the powder in question will be precipitated. The clear liquor may then be poured off, the precipitate washed, and it is fit for use.

Effect of time, in combining the oxide of Iron with earths.

About the beginning of the present century, I found a flat plate of iron, on the floor of an ancient Druidical temple, which I discovered in the forest of Saint Gobin; by means of the water which had filtrated through the mass of clay and sand, with which the iron was covered, a re-action had taken place, which rendered it extremely difficult, even with the assistance of a proper instrument, to detach any portion of the agglomerated mass.

Glass house cinders, employed in hydraulic mortar.

When the bridge of Louis XVI. was constructed, much advantage was derived from mixing with the hydraulic mortar which was used, a portion of the *escarbilles*, more or less ferruginous, which had passed the grating of the glass bottle furnace, at Meudon, near Sèvres. These *escarbilles* were pulverized, and introduced into the mortar used, and contributed to its rapid consolidation. The same benefits were experienced when the jetties and fort at Cherbourg were built; the *escarbilles*, having been obtained from the glass house of Tour-Laville, about a league and a half distant from that port.

Remarks.—The word *escarbilles*, used in the above article, we have not translated, but the English term cinders, we believe, expresses the idea with perfect precision; the French word *cendres*, means ashes only, and we do not know of any popular term in that language, corresponding to cinders, in English; the term *escarbille* is used technically only. The *Dictionnaire Technologique*, says, "this name is given in the manufactories, to those portions of the coal, which escape complete combustion, and which are mixed with the ashes. This is, a sort of coke, more or less light, and in small pieces." In these furnaces it is to be understood that pit-coal is employed.

EDITOR.

Improved paving mortar.

It is well known that the mortar used for paving quays, the yards of hotels, or other buildings, is greatly improved by being mixed with the residuum from the distillation of aqua-fortis, when baked ferruginous clay is used for the decomposition of the nitre.

Coal ashes rendering mortar water-proof.

A similar effect is produced in coal mines, when it is necessary to prevent the infiltration of water between the joinings of timbers; for this purpose the space between the earth, and the timbers, is filled with a mortar, made of lime, and the ashes of the coal, which is always ferruginous.

Cast-iron balls combining with sand.

I have seen on the sea-shore, near Cherbourg, a small ball, and a twenty-four pounder, both of cast-iron, the affinity of which had been exerted with such power, upon the sand, and the calcareous particles, accompanying it, upon which these projectiles had been rolled by the flux and reflux of the tide, that the small ball had become as large as a twenty-four pounder, and the larger one equal in size to the largest bomb-shells. The substances which were thus agglutinated had formed a mass so hard, that a pointed chisel was requisite to separate small portions of it.

Malleable Iron and Lead fused under Glass.

Malleable iron, (in the form of a nail,) and metallic lead, melted together, under glass, with an alkaline flux, appear to exert a certain action upon each other; for I have found them at the bottom of the crucible, the one incrusted by the other, and very adherent; the globule of iron was in part encased by the earth of the crucible, and the globule of lead, contained in a cavity which it had formed in the upper surface of the iron; the latter was striated on its exterior; the lead and the iron might sometimes be separated, but in general, this could not be effected.

Glass, coloured blue, by Iron.

The tritoxide of iron, formerly mentioned, mixed with sulphate of soda, and sub-carbonate of soda, give to the glass which this mixture produces, a blue colour resembling that observed when similar materials are exposed to a partial fusion, and which, in a length of time, form on the surface, about the sides, or in the backs of hearths, both of brick and of stone in reverberatory furnaces, used for the decomposition of muriate of soda, by the sulphate of iron. My observations on this production of colour, were first made about the year 1800, when I had the direction of the glass works at Tour-Laville, and was decomposing the muriate of soda, by sulphate of iron.

I have thought that these several observations which have been made by me at different periods of time, might, if published, lead to important results, and particularly the two last, in the making of ultra-marine.

On the Parolic Cement. *By* Thomas Gill, Esq.

This cement, which is termed *Parolic*, or *Universal*, from the great variety of purposes to which it is applicable, is of the class of those termed *caseous;* the curd of milk forming the principal part of its composition. It was invented by me in the year 1811; and a considerable quantity of it has since been made and sold by Mr. J. J. Hawkins, under the above title; but the composition of it has hitherto remained a secret to the public. It will perhaps be a convincing proof of its merits, to say that it is a complete substitute for the celebrated *Vancouver's Cement*, now in such universal demand.

To prepare this cement, take the unsalted curd of skimmed milk, after pressing the whey out of it, and break it into lumps: to dry these lumps distribute them upon linen sheets laid upon the floor of an airy room; and frequently, from time to time, as the curd acquires greater consistency, stir and break it into smaller masses, either with the hands, or with the assistance of a flat board, and a bar or rubber of wood; until at length it becomes dry enough to grind in a steel coffee-mill, to a powder about as fine as the best gunpowder; when it must be finally dried over a stove, and kept dry for use.

One hundred pounds of curd, from the cheese-press, will only afford about thirty pounds of the dry curd.

To ninety parts of this dried curd, ten parts of caustic quick-lime, made of blue marble, finely rubbed to powder and searced, and one part of camphor, must be added, and well mixed by rubbing the whole together with a pallet-knife upon a stone slab; and the whole must be then inclosed in bottles, holding about an ounce each; and well corked immediately afterwards, in order to prevent the access of air to the composition.

In this state the cement will remain good a long time; and, when wanted for use, a little of it must be poured out upon any flat earthen plate, &c. and, by the aid of a pallet or case-knife, be instantly mixed with a proper quantity of water, to render it of a fit consistency for the purpose to which it is to be applied.

The bottle must be again carefully closed, after taking out the quantity of cement required; as, otherwise, the lime would lose its causticity, upon which its solvent action on the caseous part of the cement entirely depends. [*Tech. Rep.*

Process by which Seal Engravers take their beautiful wax Impressions.

To the Editor of the London Mechanics' Magazine.

Sir,—In answer to a request of a correspondent, to be informed how engravers take their wax impressions, I beg leave to give the following directions; they may be prolix, but as a good impression depends upon attention to minutiæ, I consider it requisite to be as particular as I can. In the first place, clean the engraving with soap and water, then prepare the stone as follows:—Take a little grease (very little is requisite,) and rub it thinly upon the back of the hand; then, with a fine brush, (a tooth-brush will do provided the hair is very soft,) take it off and brush the stone: there will be sufficient grease upon the stone for the vermilion to adhere to; only be careful not to smear it across, but dab the brush upon it perpendicularly, by which a surface is produced resembling a mezzotinto ground. Many of the engravers pay little attention to this part; but from experience I am well convinced, that unless the stone is properly greased, the surface of the impression will never appear to advantage. Now take a camel's-hair pencil, and dip it in Chinese vermilion; turn the brush upside down, and tap gently upon the table, so that the vermilion may fall into it and not lay upon the top, otherwise it will so clog up the work, that all its sharpness will be lost; apply it to the stone, holding it perpendicularly, to preserve a smooth regular surface; when that is done, blow off the superfluous colour, and proceed as follows. Cut a strip of stout paper to put your wax upon, which melt over a candle, holding it about half an inch from the flame, (be careful not to burn or smoke it;) keep turning it round, so that the stick of wax may be melted all round; when sufficiently so, put it upon the paper, and so on till there is a sufficient quantity: take the paper and hold it over the candle, and when soft, stir it round, and continue doing so till it is of the size necessary. Take it from the candle, and continue stirring till the surface is perfectly smooth and free from air bubbles; keep the greatest portion of wax in the middle, so that there may be a good rim round the edge of the engraving: lay it down, and take up the seal (do not be hasty, it will continue hot some time,) and hold it over the candle, so that the flame just touches it. When sufficiently hot, (experience will be the best guide in this particular,)—nearly as hot as it can be borne upon the back of the hand will, perhaps, be the best guide—apply it to the wax, not hastily but steadily, holding the seal between the finger and thumb by the top: let it stand, pressing gently upon it till the wax is set, which may be told by pressing upon the edge with the nail; when it is so, put your fingers round the impression to keep it down, and pull the seal off. If the impression is good, the engraved parts will be dull; if otherwise, the work will be shining, in which case, the seal has been too cold. If the surface in the plain part is marked and rough, the seal has been too hot. Practice will soon enable you to avoid these defects. Let the wax be rather stiff than otherwise, before the seal is applied.

Your's obediently,
J. P.

Improved Gas for Illumination.

MR. HENRY PINKUS, of Philadelphia, has just obtained two patents for improvements in the methods of generating and purifying gas for illumination, upon which improved plans, a manufactory in London has been lighted up with complete success.

The gas afforded a clear and brilliant light, and was found to be wholly exempt from that fœtid odour, which has hitherto been found to emanate from gas in the most purified state in which it is furnished for consumption. We are not yet at liberty to make known the particulars of these improvements, as the Irish and Scotch patents, now in progress, are not yet sealed, but we anticipate that the public will be much benefitted by this invention, as gas-lights will, by these means, be afforded under circumstances of decidedly greater economy than has ever before been proposed.

Not the least important part of these improvements, is the simple method of purifying gas practised, and which, as far as we have yet seen, appears to be perfectly effective. It is well known, that gas in its crude state, contains portions of sulphuretted hydrogen, and carbonic acid, which, by the present system of purification adopted at the gas works, is not completely absorbed, and when burnt in close apartments, or in any considerable quantity, produces a suffocating odour, blackens paint, or tarnishes metallic substances, and causes head-ach, and other unpleasant feeling to the persons who breathe the atmosphere in its vicinity. These have been the great objections to the introduction of this desirable light into private houses, and the cause of its expulsion from many of the principal club-houses and hotels in this metropolis.

The patentee considers his method of purifying as entirely obviating these imperfections, and we have to our own satisfaction, witnessed that his gas is quite free from any unpleasant smell, even when allowed to escape unburned.

[*Newton's Journal.*

Mr. SAMUEL BROWN'S *reply to the remarks of Mr.* PERKINS, *on the subject of the Gas-Engine; in a letter to the Editor of the Times Newspaper, London.*

WE find the following letter in the *Repertory of Patent Inventions*, for December last, and we hasten to insert it, as the animadversions of which it complains, were addressed to, and published by us, and we are always desirous of affording an opportunity of defence, whenever a charge is made. The letter is preceded, in the Journal abovementioned, by an extract from the letter of Mr. Perkins, published in our number for June last, and containing the remarks to which Mr. Brown replies. The editor of the Repertory had inserted the communication of a correspondent, containing an opinion unfavourable to Mr. Brown's engine; and remarks, "we do not think Professor Millington's, and Dr. Birkbeck's opinions outweigh Mr. Perkins', and our correspondent's."

MR. BROWN'S LETTER.

"SIR—Some severe animadversions on, and I must add, ungenerous misrepresentations of, the principle and power of the vacuum engine invented by me, having appeared in your Journal of Thursday last, extracted from a letter written by Mr. Perkins, and published in an American paper, I trust you will allow me to reply to the observations and censures which have been thus widely circulated.

"Mr. Perkins boldly asserts that my invention 'has died a natural death;' for which assertion there is not the slightest foundation, my persevering and constant attention having enabled me to bring my engine to a state of perfection, nearly, if not quite, equal to the most sanguine expectations which have been formed regarding it.

"It is also stated, or rather predicted, by Mr. Perkins, that I never can succeed, because the principle of my invention is 'contrary to the order of nature.' To this I beg to reply, that one of the well understood principles of nature forms the basis on which the power of my engine is gained; viz:—the pressure of the atmosphere. I should occupy too much of your valuable paper, were I to enter into the details of the combination, and the mechanical operations by which the effect is produced, in reply to the ingenious and laboured, but ill-founded, remarks which Mr. Perkins makes to show that I do not gain any available power; but, I beg to state, with the confidence produced by long experience, that the power which I do actually gain, and can use without intermission, is at least equal to the effective power produced by the best condensing steam-engine which has ever been constructed. This fact, more satisfactory than written assertions, I am ready to demonstrate, by actual proof, to any engineer or scientific man who has a wish, and a fair claim, to be so satisfied.

"As the opinion of Mr. Perkins against me, has been so decidedly expressed and published, I may be allowed to mention, that the opinions of many eminent persons have been as decidedly advanced in my favour; particularly those of two gentlemen who justly possess the confidence of the public—Professor Millington, and Dr. Birkbeck, who have lectured experimentally on the gas-engine, at the Royal and Mechanics' Institutions, and have calculated, demonstrated, and compared its power, economy, and advantages, with reference to Boulton and Watt's, and other steam-engines, the results being considered essentially in my favour. One or two of these lectures, entering into minute details, have, I believe, been published, and I presume may be purchased. To them I refer for the proof of my assertion.

"With respect to the economy of my engine, of which Mr. Perkins is also doubtful, I beg leave to observe that, having latterly turned much of my attention to the manufacture of gas at the cheapest possible rate, I trust I shall shortly be able to prove, to the satisfaction of the public, by actual demonstration, that the gas-engine may be worked, either for loco-motive or stationary purposes, at an expense which is far exceeded by that of any steam-engine in operation.

I am, sir, &c.

Samuel Brown.

Eagle Lodge, Old Brompton, Nov. 10."

A method for taking an Impression from a copper-plate on Plaster of Paris, with ink, as in common prints.

Let the plate be filled with ink (made of the best ivory black, mixed with drying linseed oil, and ground very fine on a painter's stone) and the surface cleaned with the hand and whiting, as in common copper-plate printing. Provide yourself with a board about half an inch thick, just the size of your plate; round the edge of this, wrap some stiff paper, raised half an inch above the surface on one side, and level on the other, in the form of a trough: into this put your plate, with the prepared side upwards; then mix your Paris plaster with water, to a proper consistency, and pour it on the plate; then lifting up the trough, let it fall flat upon the table again, to drive the bubbles of air from the plate through the surface of the plaster; after you have repeated this about 12 times, let it stand an hour. Afterwards take the plate out of the trough, and the plaster, now hardened, from the plate, and you will have a very neat impression on the plaster, fit to put in a frame, and by far preferable to the best prints.

[*London Mechanics' Mag.*

Method of taking Impressions of Medals or Coins.

TO THE EDITOR.

Sir—The following is a method of taking impressions of medals or coins with isinglass. Take an ounce of isinglass; beat it in a mortar; then pick it into small pieces, put them into a half pint phial, and then fill it up with a spirituous liquor, (common brandy or Geneva will do;) put a cork into the phial, with a notch cut in one side of it for a passage of air, and then set it by the fire for three or four hours, shaking it often in that time; (the heat should be great enough to keep it near boiling all the while.) The isinglass will then be sufficiently dissolved, and the whole must be put into a cloth, and strained off; it must finally be put into a clean phial, well corked, and kept for use.

When it is wanted for use, take the glue and set it by the fire, and it will soon liquify or become fluid; then having made the medal clean, and placed it quite level, pour on as much of the glue as will cover it completely over and lie without running off. It must then be allowed to dry, (which in the summer time and dry weather will require but one or two days,) when it is quite dry, it must be taken off by entering the point of a pen-knife under one side, and it will rise off the medal in a clear, transparent, and perfect resemblance of the whole, even the most minute parts of it.

I am yours, &c.

J. C.

[*ib.*

On an Economical Blower. By the Editor.

The blowers for grates in which anthracite is burned, are frequently troublesome and inconvenient, but a substitute may be found in a common newspaper, which will answer the purpose better than those of sheet-iron, whilst the same paper may be used repeatedly, and when destroyed is replaced without the assistance of the iron-worker. All that is necessary is to spread the sheet in front of the grate, confining it by the weight of the tongs upon the ledge above the grate, or in any other simple way. The draft of the chimney will cause it to fit close at every part, and it is evident, that the lower edge of the paper may be made to reach to any depth, upon the bars of the grate which may be thought best, and which should never be below that part where the fire burns brightly. The fire may be made to burn with great intensity without consuming the paper, the exterior cool air pressing upon it, and keeping its temperature below the point of combustion. The use of this kind of blower was first mentioned to the Editor by Mr. Jesper Harding, two or three months ago, and since this period the old one of sheet iron has been allowed quietly to repose in its corner, and the hands of those who manage the fire (including all hands) have remained unscathed.

New Solar Compass.

At the last meeting of the Edinburgh Wernerian Society, a very interesting instrument was exhibited, the invention of Mark Watt, Esq. It may be thus briefly described:—twenty-five needles of the size of No. 10, are rendered magnetic, and stuck at equal distances, into a thin circular slice of cork, of three inches diameter; this circle is affixed by a copper wire to a light bar of wood, five inches long, having at its opposite extremity, a small weight equal to the weight of the needles. In the centre of the bar is an agate cap, which receives a fine steel point, on which the instrument traverses. Being secured from the action of the external air by a bell glass, and exposed to the influence of the sun's ray, the circle of magnetised needles points to the sun, and in that position, in opposition to the diurnal motions of the earth, as long as the sun is above the horizon.

Apparatus for Lubricating the Gudgeons of Mills, and the Pivots of other Machinery; invented by Mr. John Barton, *Engineer.*

This simple, and useful contrivance is described in a recent number of the *Technological Repository;* it consists of a vessel of tin, or other metal, to contain the oil, with a cover to protect it from dust; the bottom of this vessel, or cup, is perforated, and has a tube soldered in, and passing through it, which is open at both ends; the lower end of this tube is made to fit into a hole in the uppermost of the two brasses, within which the gudgeon or pivot revolves; the length of this tube is such as to rise above the oil, which is to be poured into the vessel, and by which it is, of course, surrounded. When the tube is inserted into the brass, a number of threads of woolen yarn are hung upon the tube, so that at one end they may dip into the oil, and by the other supply the quantity necessary for lubrication; this of course is regulated by the quantity of yarn used, and along which the oil will pass by capillary attraction, thus forming a syphon which will apply the oil to the bearings.

These vessels it is said have been extensively used in large works, and have been ordered for the machinery belonging to the government, at the dock-yard at Portsea.

AMERICAN PATENTS.

List of Patents granted in the United States, from August 24th, to November 13th, 1827.

FOR INVENTIONS AND IMPROVEMENTS.

Improvement in plane stocks, of cast-iron; Hazard Knowles, of Colchester, New London County, Conn., August 24.

In the composition of liquor, to start the yolk, animal oil, or grease, which wool contains, when taken from the sheep; John Goulding, of Dedham, Massachusetts, August 24.

In the mode of manufacturing wool, or other fibrous material, in which, sliver, slubbing, or roping, is unwound, or delivered, on a mule spinning machine, or drawing frame; John Goulding, of Dedham, Massachusetts, August 24.

In the mode of scouring and washing all kinds of cloths; John Goulding, of Dedham, Massachusetts, August 24.

In the mode of throwing the shuttle, or shuttles, in weaving; John Goulding, of Dedham, Massachusetts, August 24.

In the washing machine, called the accelerating washer; Moses Cass, of Caroline, Tompkins County, New York, August 29.

In making aqueducts for conveying water or gas under ground, by means of a conductor, formed of water-proof lime, as a cement for stone, wood, or brick; John M. Benham, of Bridgewater, Oneida County, New York, August 29.

In the loom, for weaving all kinds of figured goods; Horace Baker, North Salem, West Chester County, New York, August 30.

In the art of distilling, by Aikin's improved rectifiers; John M. Aikin, Philadelphia, August 30.

In the use, combination, and construction of boats; Thomas Thorpe, City of Washington, District of Columbia, August 31.

In the saw, called the two edged saw; Moses Cass, and Aaron Bull, of Caroline, Tompkins County, New York, August 31.

In the machine for paying or filling the seams of ships, and other vessels, called a pitch syringe; Daniel Flint, of Nobleboro, Lincoln County, Maine, August 31.

In the hydraulic elevator; David Corey, of New York, August 31.

In the carding machine; John Tillon, of Newtown, Fairfield County, Conn., September 8.

In the machine for moulding brick, and tile; Ezra Fisk, and Benjamin Hinkley, of Fayette, Kennebeck County, Maine, September 8.

In the magazine percussion gun-lock; James B. Lowry, of Mayville, Chatauga County, New York, September 8.

In the machine for separating the hair, and other extraneous matter, from fur of various descriptions, to prepare it for hatters' use; John Macdonald, of the city of New York, September 11.

In the open single screw, or spiral water-wheel, called the open screw water-wheel, Elijah Skinner, of Sandwich, Stratford County, New Hampshire, September 11.

In the cast-iron mill, for grinding bark; William Torrey, of Westbrook, Cumberland County, State of Maine, September 13.

In the churn; Daniel Sheldon, of Pultney, Steuben County, New York, September 13.

In the machine called the propelling water paddle wheel; John James Giraud, of Baltimore, Md., September 18.

In the mode of tanning leather; Osmond Cogswell, of Cincinnati, Ohio, September 18.

In the hoe, called the *prong hoe;* Joseph Willson, of Marlborough, New Hampshire, September 20.

In Paul Hawe's machine, for making shingles; George A. Hoard, of Antwerp, Jefferson County, New York, September 20.

In the fanning mill; Enoch Walker, of Springville, Four Corners, Susquehanna County, Pennsylvania, September 20.

In the machine for cutting shingles; George W. Dana, of Lowville, Lewis County, New York, September 20.

In a vegetable composition, or matter, for preventing or curing the scurvy, and making catchup or catsup, and various sauces; James U. Armour, of Fredericktown, Frederick County, Md., September 28.

In Israel Johnson's, junr., patent saw mill; Anson B. Graham, of Lee, Berkshire County, Massachusetts, September 28.

In the washing machine; Franklin Kellsey, of Middletown, Conn., September 28.

In the apparatus for setting saw teeth, called a spring saw set; John Boggs, of Philadelphia, Oct. 4.

In the printing press; Samuel Couillard, of Boston, Oct. 5.

In the machine called a power gained lever; Edward G. Fitch, of Blakely, Baldwin County, Alabama, Oct. 5.

In the thrashing machine; Ebenezer B. Pike, of Litchfield, Maine, Oct. 5.

In the mode of making pressed glass knobs, for furniture, &c., at one operation; John Robinson, of Pittsburg, Pennsylvania, Oct. 6.

In the construction of a flexible rack, and manner of application, for operating on ships' carriages, or other carriages, used in the marine or other rail-ways; Jesse Wood, and Paul A. Sabbator, of New York, Oct. 6.

In hydraulics; Jacob Roup, of Kenhawa County, Virginia, Oct. 6.

In the cast-iron sled shoe, and cutter shoe; Edward Trask, Sangerfield, Oneida County, New York, Oct. 6.

In Dearborn's patent warehouse balance, so called, for weighing all kinds of substances, whether gross and ponderous, or light and delicate, called Blaisdel's improved avoirdupois balance; Samuel Blaisdel, of Lancaster, Fairfield County, Ohio, Oct. 10.

In the machine for mortising and tenoning timber; John M'Clintic, of Chambersburg, Pennsylvania, Oct. 8.

In the machine for making plastering laths; Thomas Wright, and Abraham P. Howell, of Cincinnati, Ohio, Oct. 9.

In the machine called the screw cradle, for raising ships, or vessels, of any size, or weight, entirely out of water, in order to repair, or for any use required; Charles Miner, of Lyme, Conn., Oct. 12.

In the lever percussion gun-lock; John Ambler, junr., of South New Berlin, Chenango County, New York, Oct. 16.

In the construction and use of moulds with a core, for pressing glass into various useful forms; called Dummer's scallop. or cover-plate; Phineas C. Dummer, of Jersey city, New Jersey, Oct. 16.

In forming glass by the combination of moulds with mechanical powers; George Dummer, Phineas C. Dummer, and James Maxwell, of Jersey city, New Jersey, Oct. 16.

In the vertical bucket or float wheel, for propelling boats; Stacy Costill, of Philadelphia, Oct. 17.

In a bobbin tube for spinning cotton; Benjamin Hutchinson, of Philadelphia, Oct. 18.

In propelling machinery by weights; Cain Broyles, of Tellico, Munro County, Tennessee, Oct. 19.

In the trip-hammer, propelled by the foot; Ebenezer Pierce, and Joseph Hathaway, of Pultney, Steuben County, New York, Oct. 19.

In the mode of heaving down vessels; John Crowninshield, of Salem, Massachusetts, Oct. 19.

In the mode of casting types, called the mechanical type caster; Stephen Sturdevant, and Edwin Starr, of Boston, Oct. 23.

In the water-proof stiffening for hats, called "Hempstead's improved stiffening, to water-proof and stiffen hats," his former patent for the same invention, dated on the 25th day of May, 1827, being cancelled on account of a defective specification, May 25th, 1827, re-issued; Stephen Hempstead, junr., of St. Charles County, Missouri, Oct. 26.

In the machine for cutting corks; George Rawlings, of Philadelphia, Oct. 30.

In the application of the scape heat from the furnace, and the discharged steam from the engine of the ordinary high pressure steam engine, to the manufacturing of coarse salt, from salt water; Alexander Brown, of Salina, New York, Oct. 30.

In making steel cylinders or mills, as they are commonly called, for the purpose of impressing figures or devices on copper rollers for calico printing, *by biting in the figures or devices on the steel cylinders, by means of acid*, the process which is usually called etching; David H. Mason, and Matthias W. Baldwin, of Philadelphia, October 30.

In distilling; William J. Cocke, of Surrey County, Virginia, October 30.

In the planing machine; Josiah Reihm, of Savage Factory, Maryland, November 1.

In the construction of clocks; Harrison G. Dyar, of New York, November 6.

In cast-iron, or other metal hubs, for wheels of carriages; Benjamin Lyman, of Manchester, Conn., November 6.

In the method of cleaning and polishing rice, coffee, and other grain; Elijah Wilder, of Jersey city, New Jersey, November 6.

In the mode of making or manufacturing machines, for cutting fur from skins, for hatters' use, called the cant twist blades fur cutter; Charles C. K. Beach, of Portland, Cumberland County, Maine, November 10.

In the percussion gun-lock, with a magazine; Joseph Shattuck, of Jefferson County, Ohio, November 10.

In making moccasins water-proof; John Syms, of New York, November 10.

In the mode of letting water on water wheels; Michael Hildebrand, of M'Minn County, Tennessee, November 10.

In the retention or discharge of fluids, more particularly water; Bradford Seymour, of Westmoreland, Oneida County, New York, November 10.

In the musical instrument called the Kent bugle, which he denominates the harmonic pocket bugle; Richard Willis, of West Point, Orange County, New York, November 10.

In the machine for making shingles; Oliver Wheeler, Monroe County, New York, November 10.

In the mode of imitating all kinds of marble, for the fronts of houses, and perfecting and embellishing hard finished walls; Benjamin Trembley, of New York, November 13.

ENGLISH PATENTS.

List of patents for New Inventions, which passed the Great Seal, in England, from the 11*th of Oct. to the* 20*th of Nov.* 1827.

To Joseph and Thomas Hall, braziers, for an improvement in the making and manufacturing of metallic blocks, for drawing off liquids —October 11.

To Elias Carter, upholsterer, for a new covering for the roofs of houses, and other buildings—October 11.

To Joshua Horton, boiler maker, for a new and improved method of forming and making hollow cylinders, guns, ordnance, retorts, and various other hollow and useful articles, in wrought iron, or in steel, or composed of both those metals—October 11.

To Goldsworthy Gurney, surgeon, for certain improvements in loco-motive engines, and the apparatus connected therewith—October 11.

To James Stokes, merchant, for improvements in making, boiling, burning, clarifying, or preparing raw or muscovado bastard sugar and molasses—October 11.

To John Wright, engineer, for improvements in window sashes—October 11.

To James Smethurst, lamp manufacturer, for an improvement or improvements upon lamps—November 6.

To Frederick Foveaux Weiss, surgical instrument maker, for his invention of certain improvements in the construction of spurs—November 6.

To James White, engineer, for his invention of a machine or apparatus for filtering, which he denominates an artificial spring—November 8.

To John Platt, fustian dresser, by virtue of certain communications made to him by a foreigner residing abroad, for an invention of which he is in possession, of certain improvements in machinery for combing wool and other fibrous materials—November 10.

To William Collier, fustian shearer, in consequence of certain communications made to him by a foreigner residing abroad, for an invention of certain improvements in the power loom for weaving—November 10.

To John Walker, esq., for his invention of an improved castor for furniture—November 17.

To Henry Pinkus, of the city of Philadelphia, in the State of Pennsylvania, in the United States of America, gentleman, for his having invented, or found out, an improved method of purifying carburetted hydrogen gas, for the purposes of illumination—November 17.

To Mr. Samuel Sevill, clothier, for his invention of certain improvements applicable to raising the pile and dressing woolen and other cloths—November 20.

FRENCH PATENTS.

List of Patents granted by the French Government, from the 1st of April, to the 30th of June, 1827.

[CONCLUDED FROM PAGE 144.]

To M. Poyenar, Paris, for a portable pen, which supplies itself with ink—5 years.

Messrs. Risler and Dixon, of Cernay, for a loom, called the metier dixon—5 years.

Messrs. Vesin, of Cessieux, and Devannes, of Cherbourg, for a system of inclined planes suitable instead of sluices, in navigating rivers and canals—10 years.

Jean Numa Anverny, and Augustin Ginaux, of Montpellier, for a machine for making and cutting corks—5 years.

Timothy Burstall, of Leith, for an apparatus called a loco-moteur, adapted to steam carriages, and improvements in supplying boilers with water for steam—15 years.

Richard Laurent, Lieutenant in the French Navy, for a process for enabling laden craft to come up rapid rivers, by the rapidity of the current itself—15 years.

Louis Scheriz, of Strasbourg, for a process for raising silk-worms upon vegetables, without mulberry leaves, and for a method of cleaning and enlarging their beds—15 years.

Isaac Winslow, of Havre, for a machine for spinning cotton without twisting, called the rotta flotteur; ou fileur en doux economique et expeditif—5 years.

John Jones, of Leeds, for an apparatus for brushing cloths and other stuffs—10 years.

Michel Lorillard, locksmith, for a machine for preparing flax and hemp—15 years.

Jacques Augustin Gaubert, of Montpellier, for a method of procuring salt and cream of tartar, from the skins of grapes, after they have been pressed for making wine—10 years.

M. Pape, piano forte maker, Paris, for a machine for boring, and cutting veneer, and also for turning the feet of pianos, and furniture—10 years.

Andre Millet, Paris, builder, for an apparatus adapted to the tops of chimney pots, to prevent the smoke from beating down by high winds—5 years.

Albert Sakoski, Paris, boot and shoe-maker, for the invention of an elastic water-proof shoe with steel soles—10 years.

Charles Dollfus, of Cernay, for a machine for carving circles and other figures upon the rollers for printing cotton—5 years.

Jean Antoine Collombet, Bordeaux, writing master, for improvements upon the American method—5 years.

Philibert Maillot, Lyons, for the invention of a malleable and ductile metal, called maillechort—5 years.

Pierre Fusz, of Insming, Chateau Salins, for a machine, called the enrayure a levier, for locking the wheels of carriages, without requiring the coachman or postillion to alight—10 years.

Migcon, forge master, at Belfort, for a new invented pair of bellows—15 years.

Jean Henri Pape, instrument maker, Paris, for a new invented sounding board, and a superior arrangement of the hammers—10 years.

Wilhelm Scheinlein, engineer, of Langenfield, Bavaria, for a surgical instrument, called the Lithon-triptor, for breaking the stone in the bladder, and reducing it to powder—5 years.

Jean Christophe Gotten, mechanic, Paris, for a mechanical hydraulic lamp—15 years.

Louis Nicolas Debergue, Paris, for a loom for weaving flax, cotton, silk or wool—15 years.

Antoine Perpigna, Paris, for a new invented filtering stone—10 years.

Francois Antoine Sautermeister, instrument maker, Lyon, for an instrument with eleven keys, called the Nouvel ophicleide.

Charles Rule, Paris, for a process for extracting gas from all oily, pitchy, bituminous, and other substances, with great economy, security and despatch—15 years.

M. Lecarriere, gas apparatus manufacturer, Paris, for a machine for regulating the emission of the gas—5 years.

Gabriel Francois Bardel, Paris, for a method of making steel—15 years.

Auguste Sevene, Paris, for a machine for clipping cloths and stuffs—15 years.

Pierre Larguier, St. Rouan, Notary, for a new method of applying steam in silk mills, for heating the water—5 years.

M. Lepine, Paris, for a new invented lamp, with lasting wicks—5 years.

Pierre Chaussy, of Avignon, for a press for extracting olive oil, and the juice of grapes, &c.—5 years.

Jacques Etienne Morcau, steel chain maker, Paris, for a machine for making clasps—5 years.

Benjamin Devaux, Paris, for an invention for making paper and paste-board of hemp—10 years.

Andre Delcourt, Paris, for an improved machine, called a Linourges, for spinning flax, and preserving it from the damp—10 years.

Mathias Levis Lauzenberg, currier, of Strasbourg, for a machine for separating sheep, goat, and calf skins, in halves—10 years.

M. Poirot de Valcourt, Paris, for a delving machine—15 years.

William Wilmot Hall, of Baltimore, for a method of using the warm air, and other heated matters, to act upon a piston—15 years.

Silvestre Vanhoorick, Inspector General of the studs, at Strasbourg, for a carriage, which by means of a moveable shaft, cannot be overturned—10 years.

Alexander and Robert Carswell, of Greensworth, Scotland, for improvements in vessels, set in motion by machinery, acting upon the water—15 years.

Pierre Joseph Paret, of Montpellier, mechanician, for a weighing machine—15 years.

Jacques Augustin Gandais, of Paris, plated silver manufacturer, for a steam and filtering coffee pot—5 years.

NOTICES.

Delay in Publication.—Until within a day or two, scarcely any of the European Scientific Journals, of a date later than October last, had come to hand, and several are yet missing; we have waited for the intelligence which they usually contain, and this has concurred with other circumstances, in delaying the three last numbers of the Journal, an event which we hope will not again occur.

Lithography.—The number of the *Journal des Connaissances*, for December, is just received; the subject of Lithography has been resumed in it, and will of course be continued in our next.

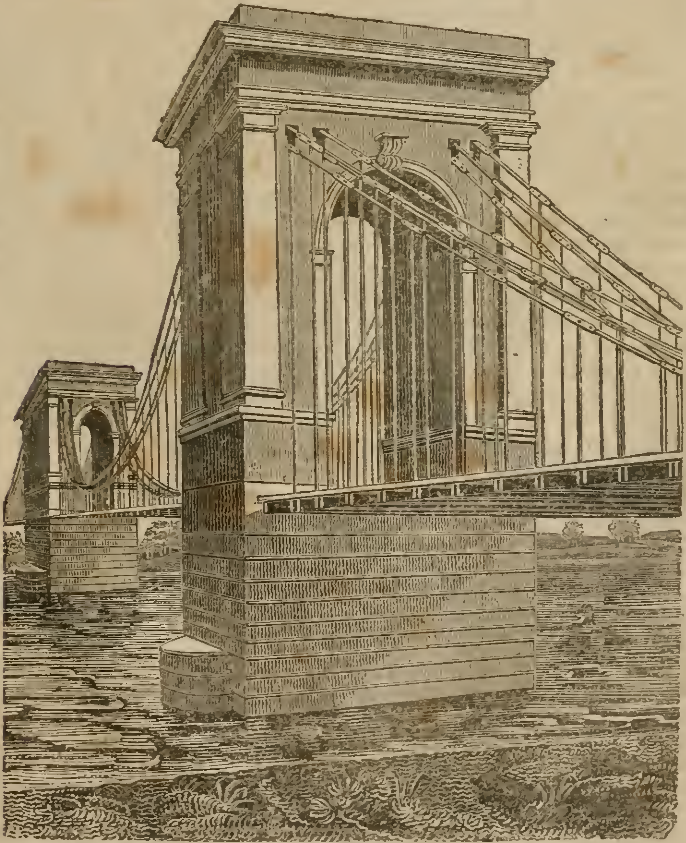
New Arrangement.—The property of this Journal, has, by an arrangement made with the Editor, passed into the hands of the Franklin Institute; this will make no change in the general mode of conducting the work, as the Editorship still vests in the individual to whom it has heretofore belonged; but the work will hereafter be published at the Institute. Agents, and subscribers, are therefore requested to direct their letters to the *Actuary*, at the Hall, who will transact all the business appertaining to the subscription for, and distribution of, the Journal.

Communications to the Editor, may also be directed to the Institute.

THE
FRANKLIN JOURNAL,
AND
AMERICAN MECHANICS' MAGAZINE;
DEVOTED TO THE USEFUL ARTS,
Internal Improvements, and General Science.

APRIL, 1828.

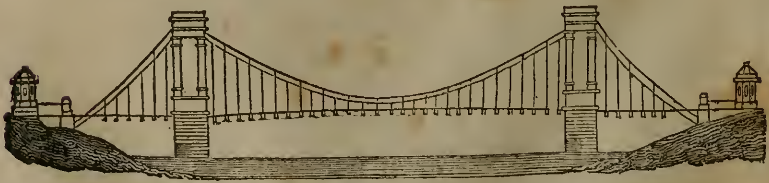
A Perspective View of the Suspension Bridge at Hammersmith.



Descriptive account of the Suspension Bridge now erecting at Hammersmith, near London. By Mr. C. Davy, *Professor of Drawing.*

Iron bridges, the invention of which is due to British ingenuity, are entirely the production of modern times. The first bridge was erected by Mr. Darby, over the river Severn, at Colebrook Dale, and affords a splendid example of the art, and of the engineer's talents. In 1808 an iron bridge was constructed at Staines, but by some unforeseen circumstance, the arch received so much damage, by settlement, that it was found necessary to remove great part of the iron work, and shore the remainder up by piers, constructed of wood. About this time, another iron bridge, erected over the river Tees, gave way; but this, instead of yielding gradually, as the bridge at Staines had done, suddenly broke down and fell into the river. Through the perseverance and talent, however, of Captain Brown, R. N., the art of bridge building on the suspension principle, has been eminently successful. But suspension bridges are said to have been in use, before the time of Scamozzi, the architect, who mentions the existence of them in his work, Del Idea Archi, 1615. It appears, the first erected in this country, [England,] was over the river Tees, about the year 1741, and formed a communication between the counties of Durham and York. Since that time, the number has been increasing; and we may now boast of having some of the finest examples of these structures. These have been followed by an attempt to introduce bridges on the suspension principle, composed of iron wire, which, on a small scale, no doubt will answer; but if of great magnitude, vibration is caused to such an extent, as to render them unsafe. The wire bridge of Dryburgh, through some mischievous persons shaking it violently, had one of the largest radiating chains broken short off, at the point of suspension: shortly after the injury was repaired, a high wind again broke the chains, and completely effected the destruction of the bridge. From the evidence of many people at the time, it appeared, that in this gale, the vertical motion of the roadway, was equal to its lateral motion, and was sufficient to precipitate a person into the river.

Fig. 2.



The iron-bar suspension bridge now erecting over the Thames, at Hammersmith, may justly vie, in point of beauty, with the most celebrated of these structures. The clear extent of the water-way, is 400 feet, from which the road-way rises 16 feet; the points of suspension are built of stone, and designed as archways of the Tuscan order, flanked by pilasters; and the part near the water is boldly rusticated: these supports are 50 feet high from the road, the thickness is 22 feet; on either end of the bridge, at its entrance, are octagonal lodges, from which project, to a small distance, dwarf walls, terminated by short circular-headed piers. as shown in the elevation, fig. 2. At a great depth behind these piers, the ballast plates, O, fig. 3, are fixed.

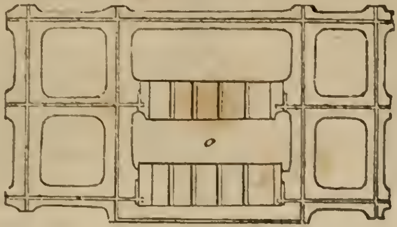


Fig. 3.

The principle of construction is as follows:—D D, fig. 4, are the suspension chains, which consist of bars of iron, 5 inches deep, by one in thickness; these are 10 feet in length, and are connected together, as shown in the annexed plan, by plates of iron, having a strong bolt passing through, and turned at the ends; these plates are placed alternately on the lower and upper chains, by which means a suspension rod, *c c*, $1\frac{1}{4}$ in. thick, occurs at every 5 feet, and these saddle pieces, or plates, (1 and 2, fig. 5,) at every 10 feet, on the lower and upper chains; the plates of the upper chain standing exactly half way between the plates of the lower chain. The suspending rods are furnished with a joint, where they are inserted into the opening, between the chains or plates, enabling them to accommodate themselves to any extraordinary weight on the bridge. There are two pairs of chains on each side of the bridge; the inner pair consists of six links, the outer ones have only three links each, (as represented in figure 5.) At the height of about 39 or 40 feet, from

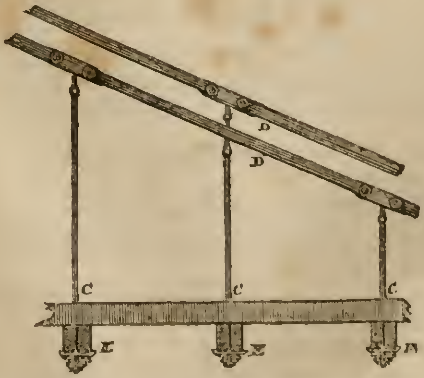
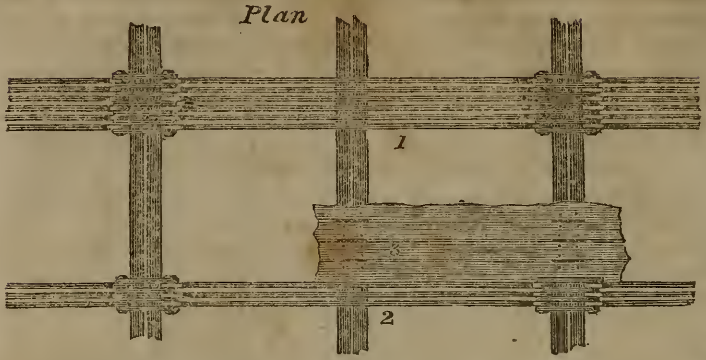


Fig. 4.

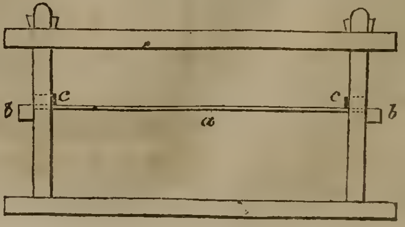
Fig. 5.



the level of the road, the chains pass through the masonry of the arches before mentioned, and over friction rollers connected to heavy cast-iron plates; the catenarian curve drops in the centre of the bridge, to about the height of a parapet: the spaces between the suspension rods will, eventually, be filled with an ornamental meshing. The road-way consists of transverse beams in two thicknesses, 4¼ by 12 inches, with an interval of 2¼ between them; these are fastened at the bottom by keys, to strong iron plates; along each side of the bridge, extend a pair of strong beams, which are firmly bolted to the flooring joists; this connexion is shown at *e e*, fig. 4. The road-way of the bridge is slightly raised towards the centre of the river, and the whole is boarded longitudinally with 3 in. planks, (as shown at 3,) with a small space left between each, to prevent any water from settling upon the bridge.

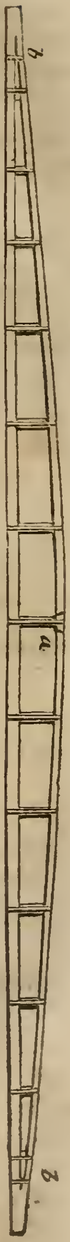
The architectural beauty given to the masonry of this bridge, is a decided improvement on the hitherto clumsy masses of stone, introduced in other erections of this description, and forms a highly ornamental appendage to the river Thames. [*Register of Arts.*

Account of some experiments on the Transverse Strength of Timber; and a description of a new Rafter, invented by Mr. Smart. *By the Editor of the Register of Arts.*



In one of our recent perambulations, in quest of new discoveries in practical mechanics, we happened to call at the manufactory of the ingenious Mr. Smart, inventor of the bow and spring rafter, (described at vol. i. page 315, of this work,) and found that he had just completed a rafter 56 feet long, on the same principle, but of improved construction. Some time ago, Mr. Smart was induced to institute a series of experiments on the strength of materials, from a doubt which he entertained, of the correctness of the results of Belidor's experiments, on the transverse strength of timber, where it is stated, that the strength of a beam is increased by fastening its ends, so as to prevent their approach when a load is placed in the middle, in the proportion of three to two. To ascertain the correctness of this, Mr. Smart placed a lath *a*, an eighth of an inch thick, into a strong frame, as shown by the annexed cut, which broke with a load of eleven pounds, placed on its middle. He next took a lath of the same wood, of equal dimensions, and fixed it firmly at the ends, by means of the projecting pieces *b b*, and the wedges *c c*, and ascertained that it would sustain by this arrangement, the enormous load of 270 pounds: hence it appears that the strength of a lath is increased, between twenty-four and twenty-five times, merely by securing it well at the ends.

This important discovery was turned to account by Mr. Smart, in the construction of rafters, which he denominates *bow* and *string rafters*. He considered that the principal defect in fixing the ends of rafters, was the want of sufficient stability in their supports, and he has contrived to make the abutments within the rafter itself, and thus to take advantage of the longitudinal strength of the timber, as represented in the annexed figure. This rafter, which is 56 feet between the bearings, is made out of a scantling 10 inches by 4 inches. An incision is made by a circular saw from the middle nearly to each end: a transverse cut is then made at *a*, through the middle of the upper part of it; and at each end *b b*, of the incision, a transverse piece, of a wedge shape, is cut out, reaching nearly to the longitudinal incision, but not so near as to separate the parts.



Roofs, constructed on this principle, possess many advantages, among which may be enumerated their extreme lightness, their flatness, and the economy of their erection: and we think the invention may be safely characterized as one of the most important and valuable in the art of building in modern times.

On the Preparation of Enamel Colours and Fluxes; and the vehicles for laying them on. By MR. ROBERT WYNN.

[Concluded from p. 172.]

YELLOW ENAMELS.

Red lead - 8 parts, Oxide of antimony 1 part,
White oxide of tin 1 part.

Mix the ingredients well in a biscuit-ware mortar; and having put them on a piece of Dutch-tile in the muffle, make it gradually red-hot, and suffer it to cool.

Take of this mixture 1 part, Of Flux, No. 4, 1½ parts.
Grind them in water, for use.

By varying the proportions of red-lead and of antimony, different shades of colour may be obtained.

Another Yellow Enamel.

Take three parts, by weight, of sheet-lead, and one part of block-tin; melt them together in a ladle or a flat shovel, and skim off the top as fast as it oxidates. When a sufficient quantity is thus obtained, place it in the muffle, in a gentle reverberating heat, to calcine any remaining particles of metal:*

Of which, take - 7½ parts, Oxide of antimony, 1 part,
Litharge, - 1 part.

Mix these well together, and give them a red heat in a muffle, sufficient to bind them together, but not to melt them. Use the same flux as for the other yellow.

Orange Enamel

Take red lead, 12 parts, Red sulphate of iron, 1 part,
Oxide of antimony, 4 parts, Flint powder, - 3 parts;
well mixed together in the mortar, and heated, so as to adhere together, but avoid melting.

Take of the above, 1 part, Flux, No. 7, - 2½ parts.
Grind for use.

Dark Red Enamel.

Brown sulphate of iron, 1 part, Flux, No. 7, - 2½ parts.
Grind for use.

Light Red Enamel.

Red sulphate of iron, 1 part, Flux, No. 1, - 3 parts,
White lead, - 1½ parts.
Grind for use.

Red Brown Enamel.

Brown sulph. of iron, 1 part, Flux, No. 1, - 3 parts.
Grind for use,

Vandyke Brown Enamel.

Flux, No. 4. - 3 parts, Iron filings, - 1 part,
melted together in a crucible, and drawn out with tongs;† with so much metal it will not pour out freely.

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* This, after being finely ground, forms the *putty* so much used in polishing steel, &c.

† In this, and in other cases where a muffle is not in readiness, an earthen crucible, washed over with flint powder inside, or with dry flint powder rub-

Take of the preceding, 5 parts, Black oxide of cobalt, 1 part.
Grind for use.

Another Brown Enamel.

Manganese, - $2\frac{1}{2}$ parts, Red lead, - $8\frac{1}{2}$ parts,
Flint powder, 4 parts.
Heated, so as to stick together.
Of this mixture take, $1\frac{1}{2}$ parts, Flux, No. 4, - 1 part,
Iron filings, - $1\frac{1}{2}$ parts.
Grind for use.

Black Enamel, for Painting, and mixing with other Colours.

Umber, broken into small pieces, and calcined in a yellow heat, in a crucible, till quite black, then washed in boiling water and dried:
Of this take 10 parts, Black oxide of cobalt, 10 parts,
Blue flint glass, $10\frac{1}{2}$ parts, Borax, uncalcined, $7\frac{1}{2}$ parts,
Red lead, - 12 parts.
Heat these well together.
Take of the above, 2 parts, Flux, No. 4, - 1 part.
Grind in water for use.

Blacks are compounded in other proportions of these ingredients, and manganese is sometimes substituted in the place of umber.

Another Black Enamel.

Umber, calcined black, 1 part, Black oxide of copper, $\frac{1}{2}$ a part,
Black oxide of cobalt, $1\frac{1}{2}$ parts, Flux, No. 4, - 3 parts.

Grind these in water, and, when dried, place them on a piece of Dutch tile, (previously washed over with flint powder, ground in water,) in a muffle, in a charcoal fire, and heat them so as to bind together; then add half a part of Flux, No. 4.

These blacks, if too soft, are hardened by adding a little black oxide of cobalt.

Black Enamel for Shading, and Drawing under the Greens

Manganese, - 5 parts, Royal smalt, - 1 part,
ground fine in water, and heated to a high degree in a muffle.

Beautiful Black Enamel, for Solid grounds, or Inlaying, but does not mix generally.

Black oxide of copper, 1 part, Flux, No. 4, - 2 parts.
Grind in water for use.

A Frit, for Transparent Green Enamels.

Flint powder, - 3 parts, Flux, No. 2, - 3 parts,

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bed inside of it, one-eighth of an inch in thickness, may be used; and the materials, when partially melted, so as to bind together, may be then entirely taken out without loss.

Green pot-metal glass, 1½ parts, Red lead, - - 7½ parts,
Borax, uncalcined, 2½ parts, Green oxide of cop. 1¼ parts.

Melt them in a crucible, pour out the mass, and powder it in an earthenware mortar.

Green Enamel.

Take of the green frit, 3 parts, Of yellow enamel, 1½ parts.
If too soft, add Naples yellow.
Grind in water for use.

Another Green Enamel.

Green frit, - 5 parts, Flux, No. 2, - ½ a part,
Flux, No. 6, - 2½ parts.
Grind in water for use.

Greens, for painting in enamel, are formed of various shades, by mixing blue and yellow, blue and orange, &c. in different proportions.

Blue Enamel.

Black oxide of cobalt, 4 parts, Flint powder, - 9 parts,
Nitre, - - 13 parts.

Mix the ingredients well in an earthenware mortar, and heat them in a crucible, in a strong fire of coke and charcoal, till perfectly melted;* then powder the mass, wash it in cold water, and dry it.

Of this, take - 1 part, Flux, No. 5, - 1 part.
Grind in water for use.

Another Blue Enamel.

Black oxide of cobalt, 1 part, Borax uncalcined, 1 part.
Melt them together.
Of this mixture take, 2 parts, Blue pot-metal glass, 10 parts,
Red lead, - - ½ a part.

Melt them in a very strong fire. If either blue is too soft, add a little royal smalt; if too hard, a little flux, made of

Blue glass, - 2 parts, Borax, - 1 part.

Purple Enamel.

Take fine gold from the refiners, and dissolve it to saturation in an aqua-regia made as follows:

Of the strongest nitric acid, 1 part, by measure,
Muriatic acid, - 3 parts, Distilled water, - 3 parts.

Make the solution in a clean Florence oil-flask, placed on sand near the fire. Pour melted tin into cold water, to granulate it, and dissolve it to saturation in diluted aqua-regia, 4 parts. Place the tin and the acid in a large basin, covered with an earthen plate, in a temperate heat: when the tin is all dissolved, add still more tin, and also strong red fuming nitrous acid 1½ parts; and again dissolve the tin to saturation, covering the basin with the plate, to prevent the fumes from escaping. After standing twenty-four hours, a little distilled water should be poured into the basin. The solution of tin may then be put into a clean phial, for use, adding to it a few grains of tin; examine it, after four or five days, when the solution, if carefully made, will be of a fine clear dark colour, and fit to make purple with.

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* If these preparations are not sufficiently fluid, in the melted state, to pour out of the crucible, the colour will adhere to a piece of steel bar, when it is warm, and may be drawn out; and sometimes the blues are made in crucibles lined with flint powder, as before mentioned.

Then, of the solution of gold, take sufficient to make distilled water of a faint yellow colour, and drop gradually into it the solution of tin, till the last added drops occasion no turbidness in the liquor, and a most beautiful purple precipitate will immediately be formed, which must be thrown, as it is made, into a large vessel, and two or three pieces of the granulated tin should be put at the bottom of the vessel. The precipitate is then to be washed in several hot waters, filtered on the blotting paper and canvass, and, while in a moist state, is to be mixed with the flux, No. 4, finely powdered.

The proportion of the flux to the purple precipitate, is always various, and is judged of by the mass being of a good, rich, dark colour, as the ingredients are ground together on the plate-glass. Care must be taken to grind this colour before it gets dry.

Twenty-four grains of gold made into a precipitate in this manner, will take two ounces of flux; and this may be a rule to the inexperienced practitioner.

Rose-coloured Enamel.

To a saturated solution of gold in aqua-regia, (containing twenty-four grains of gold,) diluted with 100 times its bulk of warm distilled water, having 20 grains of alum* dissolved in it; add caustic ammonia, drop by drop, as long as any precipitate is thrown down, which precipitate wash in several hot waters.

To 24 grains of gold, precipitated in this manner, add

Flux, No. 4,	- 2 ounces.	Flux, No. 3,	- 2 ounces.

Mix them together wet, and grind them on a plate-glass, adding, by a leaf at a time, 16 leaves of leaf-silver: when the whole is ground fine, let it be dried on the glass, scraped off, and put into a bottle for use.

This rose-colour grinds of a gray, or slate colour; but, after being ground, if it be placed in a muffle, and exposed to a gentle heat, it will turn to a red colour: it is fit for use in either state.

If too yellow, add a little purple; and if too purple, add more leaf-silver.

Another Rose-coloured Enamel.

Take purple, made as before directed,		- -	1 ounce.
Flux, No. 3,	- 4 ounces.	Muriate of silver,	10 grains.

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* The rose-colour is sometimes made without any alum.

The latter ingredient is prepared, by dissolving silver in aquafortis, and precipitating it with common salt.

Grind in water for use. If too purple, add more muriate of silver.

Opaque White Enamels.

Hartshorn shavings, burnt in a crucible, in a charcoal fire, till perfectly white, - 1 part. Flux, No. 1, - 1 part.

Grind in water for use.

Venetian white cake enamel, 1 part. Flux, No. 8, 1 part.

Grind in water; then heat them together in a muffle.

Flux, No. 2, powdered and washed, then dried and heated in a muffle.

It would not be difficult to exhibit a multitude of specimens of different tints, and to fill a volume with descriptions of them, merely by combining these original enamel colours in various proportions: this, however, may safely be left to the taste and experience of the artist. My object has been, to avoid every thing superfluous; and, at the same time, to explain the processes adapted to immediate practice, in terms not liable to be mistaken.

Account of some of the Processes in the Manufacture of Edge Tools and other Steel Instruments. By Samuel Parkes, F.L.S., &c.

[Concluded from p. 201.]

In the year 1789, Mr. David Hartley took out a patent for a method of tempering steel by the aid of a pyrometer or thermometer, applied near to the surface of the article, and at the same time recommended the use of heated oil, in which he says many dozens of razors, or other tools, might be tempered at once with the utmost facility, and the various degrees of heat necessary for the different purposes might speedily be determined by experiment.

When I first saw this announced in the public journals, it immediately occurred to me that the principle might be improved upon, and if a bath of oil, or of some kind of fusible metal, were contrived for the tempering of every species of edge tool, that a greater degree of certainty would be given to this operation, than the persons who have generally the conduct of such manufactories have ever experienced.

Influenced by these views of the subject, I determined long ago, that I would embrace some opportunity of instituting a series of experiments, to determine at what degrees of temperature all the common kinds of oil enter into ebullition, and also the melting points of several metallic compounds, in order to be able to furnish the practical cutler with a few tables, from whence he might learn how to construct a bath, in which he could at all times impart the desired temper to the particular instruments of his manufacture, with the utmost certainty, and with unusual despatch. These experiments have been performed, and those results which were deemed most important will be given in a tabular form in the appendix to this volume.

In the application of this principle of tempering edge tools in a fluid menstruum, whether metallic or otherwise, it will be adviseable to have the bath which is to contain the heated fluid, made of cast-iron, which should vary in form and size, so as to adapt it to the particular sort of tools or instruments which are to be tempered within it. And where the business is considerable, it would be convenient to have two such baths fixed in brickwork, adjoining to each other, and heated by the same fire, with registers to cut off the communication of either of them with the fire-place at pleasure, so that one might be heating while the workman was tempering his goods in the other.

Many advantages would result from this method of tempering edge tools. In the first place, there could never be any uncertainty as to the degree of temper which the articles would acquire; for, when the manufacturer had once ascertained which of the metallic baths was suitable for any particular kind of edge tool, all that would be necessary would be to arrange the goods in rows upon the surface of the congealed metal, to light a fire underneath the containing vessel, and then carefully to observe when the surface of the fusible metal begins to melt. As soon as this takes place, the edge tools are immediately to be removed and plunged into cold water, by which means the whole parcel will have acquired exactly the same temper.

Secondly, where instruments have a thick back and a fine edge, it is almost impossible ever to give them a uniform temper by the old method; for there will always be a danger of the edge being lowered too much before the other parts become regularly heated throughout. This difficulty occurs particularly in razors, where the thickness of the back is always a formidable obstacle to the attainment of a uniform regularity of hardness. It may, however, be determined by means of nitric acid, whether a razor or other polished edge tool be of an equal degree of hardness: for, on applying this acid to bright steel, the black tinge will appear more speedily and strongly upon the hard parts than on the rest of the surface.

Formerly, no man in Great Britain knew how to temper a sword in such a way that it would bend for the point to touch the heel and spring back again uninjured, except one Andrew Ferrara, who resided in the Highlands of Scotland. The demand which this man had for his swords was so great, that he employed workmen to forge them, and spent all his own time in tempering them; and found it necessary, even in the day-time, to work in a dark cellar, that he might be better able to observe the progress of the heat, and that the darkness of his workshop might favour him in the nicety of the operation. Had this ingenious artist thought of a bath of oil, he might have heated this by means of a furnace underneath it, and by the use of a thermometer, to the exact point which he found necessary; though it is inconvenient to have to employ a thermometer for every distinct operation. Or, if he had been in possession of a proper bath of fusible metal, he would have attained the necessary certainty in his process, and need not have immured himself in a subterranean apartment.

The swords which were formerly in the highest repute, were made at Damascus in Syria. The method by which these were made, has long been lost; or perhaps it was never thoroughly known to Europeans; but it is supposed that they were formed by alternate layers of extremely thin plates of iron and steel bound together with iron-wire, and then firmly cemented together by welding. These weapons never broke, even in the hardest conflict, and yet they retained so powerful an edge, that the armour made like net-work with scales of iron, or with small iron rings, called coats of mail, was instantly divided under their force.

This manufactory at Damascus had formerly the greatest reputation throughout Europe, and through a great part of Asia; but in the latter end of the fourteenth, or at the beginning of the fifteenth century, Timour Bec, usually called Tamerlane, on his conquest of Syria, carried away all the best workers in steel from Damascus to Persia, and we know so little of Persia, that it may be difficult now to ascertain whether this peculiar manufactory is still carried on in that country or not.

A writer in Nicholson's Journal, who had the opportunity of examining a real Damascus blade, which had cost the possessor twelve guineas at Constantinople, has thus described it: "It had (says he) a dull gray or bluish appearance, was scarcely harder than common steel from the forge, was not easily bended, and when bended had no spring to recover its figure. Its back was smooth, as were also two narrow sloped surfaces which formed its edge under an angle of about 40 degrees; but its flat sides were every where covered with minute waving lines in masses in all directions, not crossing each other, and, for the most part, running in the direction of its length. The lines were in general as fine as harpsichord wire, not extremely well defined nor continued; and their distinction from each other was effected by no perceptible indentation of the surface, but rather by the succession of parts differing in the degree of polish or brightness."

"I was informed," says the writer of the memoir, "that if any part of this blade were made smooth by grinding or whetting, the wavy appearance, called the water, could be again produced by means of lemon juice; and that its excellencies were, that it could be depended upon not to break; and that it would cut deeper into a soft substance, such as a pack of wool, or into flesh, than any other kind of sword blade."

"I infer, therefore," adds the writer, "that the Damascus steel is in fact a mechanical mixture of steel and iron; that it is incapable of any considerable degree of hardness, and consequently is in no danger of breaking from its brittleness; that its tenacity is ensured not only from the admixture of iron, but likewise from the facility with which its soundness may be ascertained throughout, by the same process which exhibits the water or fibrous appearance; and, lastly, that the edge of a weapon formed of this material must be rough, on account of the different resistance which the two substances afford to the grindstone, in consequence of which it will operate as a saw, and more readily cut through yielding substances than such cutting tools as are formed of a more uniform substance."

The conjectures of this writer respecting the methods by which these blades were manufactured at Damascus, and the account of the experiments which he himself undertook for the purpose of enabling him to imitate them, are extremely interesting and instructive, so much so that I have no hesitation in recommending the whole paper to the perusal of all those who are curious in the manufacture of edge tools.

I would not have it understood that I wish to lay any claim to the merit of the discovery of metallic baths for the tempering of edge tools, because I know of two or three individuals who, for some particular articles, have for several years adopted this expedient; but I have reason to believe that the few cutlers who have been in the habit of tempering in a fluid bath, have always employed a thermometer; whereas the object of my experiments is to furnish a list of baths, either of which may be used with certainty, without employing that instrument. Moreover, as the practice is very much confined, and few workmen, comparatively, have any idea that it would be possible to render such a method available, I was desirous of explaining its principles, and of furnishing a scale by which the manufacturer might acquire the means of tempering any instrument whatever, in such a manner as will render it entirely suitable to the purpose for which it is intended.

Another kind of edge tool remains to be described, which is made of *cast-iron,* and afterwards converted into steel. The method of conducting this process was discovered by Mr. S. Lucas, of Sheffield, and he has obtained a patent for the invention.

The invention by Mr. Lucas, of converting edge tools made of cast-iron into good steel, appears to be an important improvement. It consists in stratifying the cast articles, in cylindrical metallic vessels, with native oxide of iron pulverized, or sand containing oxide of iron, and then submitting the whole to a regular heat in a furnace built for the purpose. It is not necessary that the oxide employed should be a *native* oxide, any artificial oxide being equally effective; that kind which can be had cheapest is therefore generally preferred. The operation may be thus explained:—

The cast-iron of which this cutlery is made, is brittle in the first instance, like other cast-iron, in consequence of the carbon contained in it; but the great heat which it undergoes, aided by the pulverized oxide, separates the carbon: this uniting with the oxygen of the ground oxide of iron, is dissipated in the state either of carbonic oxide or carbonic acid gas, and the goods are then converted into a state very similar to that of good cast-steel cutlery.

To prevent misconception, it may be necessary to state, that cast-iron which contains a *large* proportion of carbon is less brittle than that which is combined with a smaller quantity. It can also be filed and cut with a cold chisel, while the latter, although it can be more readily broken, effectually resists the action both of the chisel and the file. In conformity with these facts, small machinery made of common cast-iron may be softened merely by cementation with a carbonaceous substance, thereby augmenting its dose of carbon, and rendering it capable of being smoothed by the file.

I understand that the best pig-iron is always chosen for making the various articles of cutlery, while the poorest iron ore, if free from sulphur, may be pulverized and stratified with them to afford oxygen.

After several years' experience, Mr. Thomas Lucas has been enabled to bring this process to such a state of perfection, that his cast cutlery will bear a polish equally brilliant with the best cast-steel goods, as I can testify from my own observation; and will also take as fine an edge, so that some of the best judges of cutlery cannot distinguish the difference. When, however, the cast cutlery wares, which have been thus annealed, are submitted to the usual processes of hardening and tempering, they are apt to be more brittle than those edge tools which are made in the usual way with the best steel.

It has also been found that by varying the process, small pig-iron castings can be converted into good malleable iron: in consequence of this, the patentee now makes a great variety of small iron utensils by *casting*, which were formerly made only on the anvil of the blacksmith; and when he has converted the metal to the quality of soft malleable iron, these articles are found to be equally fit for a great variety of purposes, and can be afforded at a much lower rate than similar goods which have been modelled by hand, as heretofore. He has become so complete a master of this business, that he can convert cast-iron goods either into the state of wrought iron or steel at pleasure.

ACTIVE AND PASSIVE STRENGTH.

Active Strength, or Animal Energy of Men, Horses, &c.

[From Gregory's Mathematics for Practical Men.]

[CONTINUED FROM PAGE 198.]

17. Among quadrupeds, those which are employed to produce a mechanical effect are, the dog, the ass, the mule, the ox, the camel, and the horse. Of these the *horse* is the only one, so far as we are aware, whose animal energy has been subjected to cautious experiments; and even with regard to this noble animal, opinions as to actual results are very much afloat. The dynamic effort of the horse is, however, probably, about 6 times that of a strong and active labourer. Desaguliers states the proportion as 5 to 1, coinciding with the deductions of Smeaton. The French authors usually regard 7 men as equivalent to one horse. As a fair mean between these, I assumed in vol. I. of my *Mechanics* the proportion of 6 to 1, and stated the strength of a horse as equivalent to 420 lbs. at a dead

pull. But the proportion must not be regarded as constant; but, obviously, varies much, according to the breed and training of the animal, as well as according to the nature of the work about which he is employed. Thus the worst way, as De la Hire observed, of applying the strength of a horse is to make him carry a weight up a steep hill; while the organization of a man fits him very well for that kind of labour: hence *three* men climbing up such a hill with a weight of 100 lbs. each, will proceed faster than a horse with a load of 300 lbs.

18. In the memoirs of the French Academy for 1703, are inserted the comparative observations of M. Amontons, on the velocity of men and of horses; in which he states the velocity of a horse loaded with a man and walking to be rather more than 5¼ feet per second, or 3½ miles per hour, and when going a moderate trot with the same weight to be about 8½ feet per second, or about 6 miles per hour. These velocities, however, are somewhat less than what might have been taken for the mean velocities.

19. But the best way of applying the strength of horses is to make them draw weights in carriages, &c. To this kind of labour, therefore, the inquiries of experimentalists should be directed. A horse put into harness and making an effort to draw, bends himself forward, inclines his legs, and brings his breast nearer to the earth; and this so much the more as the effort is the more considerable. So that when a horse is employed in drawing, his effort will depend, in some measure, both upon his own weight and that which he carries on his back.

Indeed, it is highly useful to load the back of a drawing horse to a certain extent; though this, on a slight consideration, might be thought to augment unnecessarily the fatigue of the animal: but it must be recollected that the mass with which the horse is charged vertically is added in part to the effort which he makes in the direction of traction, and thus dispenses with the necessity of his inclining so much forward as he must otherwise do: and may, therefore, under this point of view, relieve the draught more than to compensate for the additional fatigue occasioned by the vertical pressure. Carmen, and wagoners in general, are well aware of this, and are commonly very careful to dispose of the load in such a manner that the shafts shall throw a due proportion of the weight on the back of the shaft horse.* This is most efficaciously accomplished at Yarmouth, in Norfolk, where a number of narrow streets connecting the market-place with the quay, have led to the invention and use of the low, strong, narrow carts, thence denominated *Yarmouth carts*, drawn by one horse; and on which the loads are frequently shifted, especially when the vehicles pass over the bridge, in order to give the animals better foot-hold, and consequently a greater dynamic effort.

20. The best disposition of the traces during the time a horse is drawing is to be perpendicular to the position of the collar upon his

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Indeed, it is highly useful to load the back of a drawing horse to a certain extent; though this, on a slight consideration, might be thought to augment unnecessarily the fatigue of the animal: but it must be recollected that the mass with which the horse is charged vertically is added in part to the effort which he makes in the direction of traction, and thus dispenses with the necessity of his inclining so much forward as he must otherwise do: and may, therefore, under this point of view, relieve the draught more than to compensate for the additional fatigue occasioned by the vertical pressure. Carmen, and wagoners in general, are well aware of this, and are commonly very careful to dispose of the load in such a manner that the shafts shall throw a due proportion of the weight on the back of the shaft horse.* This is most efficaciously accomplished at Yarmouth, in Norfolk, where a number of narrow streets connecting the market-place with the quay, have led to the invention and use of the low, strong, narrow carts, thence denominated *Yarmouth carts*, drawn by one horse; and on which the loads are frequently shifted, especially when the vehicles pass over the bridge, in order to give the animals better foot-hold, and consequently a greater dynamic effort.

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breast and shoulders: when the horse stands at ease, this position of the traces is rather inclined upwards from the direction of the road; but when he leans forward to draw the load, the traces should then become nearly parallel to the plane over which the carriage is to be drawn; or, if he be employed in drawing a sledge, or any thing without wheels, the inclination of the traces to the road, should (from careful calculation) be about 18½°, when the friction is one-third of the pressure.

21. When a horse is made to move in a circular path, as is often practised in mills and other machines moved by horses, it will be necessary to give the circles which the animal has to walk round the greatest diameter that will comport with the local and other conditions to which the motion must be subjected. It is obvious, indeed, that, since a rectilinear motion is the most easy for the horse, the less the line in which he moves is curved, with the greater facility he will walk over it, and the less he need recline from a vertical position: and besides this, with equal velocity the centrifugal force will be less in the greatest circle, which will proportionally diminish the friction of the cylindrical part of the trunnions, and the labour of moving the machine. And, further, the greater the diameter of the horse-walk, the nearer the chord of the circle in which the horse draws is to coincide with the tangent, which is the most advantageous position of the line of traction. On these accounts it is that, although a horse *may* draw in a circular walk of 18 feet diameter, yet in general it is adviseable that the diameter of such a walk should not be less than 25 or 30 feet; and in many instances 40 feet would be preferable to either.

22. It has been stated by Desaguliers and some others, that a horse employed daily in drawing nearly horizontally can move, during eight hours in the day, about 200 lbs. at the rate of 2½ miles per hour, or 3⅔ feet per second. If the weight be augmented to about 240 or 250 lbs., the horse cannot work more than six hours a day, and that with a less velocity. And, in both cases, if he carry some weight, he will draw better than if he carried none. M. Sauveur estimates the mean effort of a horse at 175 French, or 189 averd. pounds, with a velocity of rather more than three feet per second. But all these are probably too high to be continued for eight hours, day after day. In another place, Desaguliers states the mean work of a horse as equivalent to the raising a hogshead full of water (or 550 lbs.) 50 feet high in a minute. But Mr. Smeaton, to whose authority much is due, asserts, from a number of experiments, that the greatest effect is the raising 550 lbs. forty feet high in a minute. And, from some experiments made by the Society for the Encouragement of Arts, under the direction of Mr. Samuel Moore, it was concluded, that a horse moving at the rate of three miles an hour can exert a force of 80 lbs. Unluckily, we are not sufficiently acquainted with the nature of the experiments and observations from which these deductions were made, to institute an accurate comparison of their results. Neither of them ought to express what a horse can draw upon a carriage; because in that case friction only is to be

overcome (after the load is once put into motion); so that a middling horse, well applied to a cart, will often draw much more than 1000 lbs. The proper estimate would be that which measures the weight that a horse would draw up out of a well; the animal acting by a horizontal line of traction turned into the vertical direction by a simple pulley, or roller, whose friction should be reduced as much as possible.

23. Mr. Tredgold, in his recent publication on Rail-roads, has directed his attention to the subject of "*horse power.*" We have already quoted his expression for the power of a horse, $250\,v\left(1-\frac{v}{\mathrm{V}}\right)$ and $\frac{250\,d\,v\left(1-\frac{v}{\mathrm{V}}\right)}{1+n}$ for the day's work in lbs. raised one mile; d being the hours which the horse works in a day, and the weight of the carriage to that of the load as $n:1$. He also gives $\frac{14\cdot7}{\sqrt{d}}$, for the greatest speed in miles per hour, when the horse is unloaded. These expressions must, at present, be regarded as tentative; and with all our respect for that truly ingenious and indefatigable author, we, as yet, suspend our judgment in reference to their perfect accuracy. But Mr. Tredgold is a man of experience as well as of competent science; so that whatever he advances on a subject of mixed research deserves attention. We select, therefore, the following tablet of the comparison of the duration of a horse's daily labour and maximum velocity, unloaded.

Duration of labour. *Hours.*	Max. velocity unloaded in miles per hour.
1	14·7
2	10·4
3	8·5
4	7·3
5	6·6
6	6·0
7	5·5
8	5·2
9	4·9
10	4·6

Taking the hours of labour at 6 per diem, the utmost that Mr. Tredgold would recommend, the maximum of useful effect he assigns at 125 lbs. moving at the rate of three miles per hour, and regarding the expense of carriage, in that case, as unity; then,—

Miles per hour.	Proportional expense.	Moving force.
2	$1\frac{1}{8}$ or 1·125	166 lbs.
3	1	125 —
$3\frac{1}{2}$	$1\frac{1}{35}$ or 1·0285	104 —
4	$1\frac{1}{8}$ or 1·125	83 —
$4\frac{1}{2}$	$1\frac{1}{3}$ or 1·333	$62\frac{1}{2}$ —
5	$1\frac{4}{5}$ or 1·8	$41\frac{2}{3}$ —
$5\frac{1}{8}$	2	$36\frac{1}{2}$ —

That is, the expense of conveying goods at 3 miles per hour, being 1; the expense at 4½ miles per hour, will be 1⅓; and so on, the expense being doubled when the speed is 5⅛ miles per hour.

24. Thus, according to Mr. Tredgold, we have for the day of 6 hours 2250 lbs. raised one mile. And Mr. Bevan, who has made many experiments on the force of traction to move canal boats on the Grand Junction Canal, found the force of traction 80 lbs., and the space travelled in a day 26 miles; hence, it is only equivalent to 26 × 80 = 2080 lbs. raised one mile for the day's work; the rate of travelling being 2.45 miles per hour; and the result a little less than Mr. Tredgold's, the difference probably arising from the deviation of the angle of the catenary from the horizon.

[TO BE CONTINUED.]

ON GILDING.

On the Preparation of Gold, and the art of Gilding in Size, Oil, &c.

[Concluded from p. 168.]

Oil-Gilding, to stand the weather.

The object to be gilt, whether of metal, stone, or wood, must be coated three times over, with a mixture of linseed oil, white lead, and a small quantity of spirit of turpentine: if it be wood, it should be previously rubbed with glass-paper or fish-skin. When the last coat is dry, the work should be gold-sized, thus: take any quantity of the gold-size, described at the end of this article, and, with a common hog's-hair brush, mix it with boiled linseed oil, till it is so thin, that, when a little of it be laid on the work to be gilt, the white paint, before put on, will appear through it; though it must not be made so thin as to lose the tinge of the yellow ochre: then proceed to lay it on sparingly, with fine hog's-hair brushes, proportioned to the size of the parts of the work. When the gold-size is good, it will dry in twelve hours: if laid on in the evening, it will be fit for gilding the next morning. Sometimes, in winter, and when the gold-size is fresh made, it will take two or three days: to prevent this, an expedient, unknown to the generality of gilders, may be used; which is, to mix with it a small quantity of japanners' gold-size: this will hasten the drying: but, in this case, when it begins to have the *tack*, hereafter to be explained, it dries very quickly; therefore great care should be taken to get the gold on as fast as possible. In order to ascertain its fitness for receiving the gold, the work must be touched with the finger: if it feel somewhat adhesive or clammy, but not so as to be brought off by the finger, it has the *tack*, or, in other words, it is in a fit state for gilding; but if it be so clammy as to come off, on being touched, or have any inclination thereto, it is not sufficiently dry: if it have no adhering quality, it is too dry, and must be sized over again before it can be gilt. In laying on the gold, a *tip* is used, which must be previously rubbed with a little tallow, to make it hold; but it must be so little, as to show no appearance. When the surface to be gilt, whether round, hollow, or flat, is sufficiently large and plain to receive whole leaves, they must be given from the book of gold, which must be held in the left hand, by the part that is sewed, the leaves be turned carefully over, and always be kept so steady, that the gold may be undisturbed and lie perfectly flat. Then take the *tip* in the right hand, and touch the leaf-gold, about half an inch deep on the side opposite to the sewing of the book: both hands must then be moved to the place meant to be gilt. Having laid the edge of the leaf, already attached to the tip, upon the work, which is always considered as having the *tack*, it will be caught and held fast by the gold-size, and the tip will be left at liberty. The book must then be slowly drawn away; followed, as it moves, by the tip; which is now used, gently to press the gold close to the work, until the whole leaf is on: this must be repeated, until those parts which are large enough to receive a leaf, are all gilt. This method is in use with a few of the best gilders, and may be acquired in an hour's practice. For those parts that are too small for the entire leaf, it is necessary to use a cushion; upon which about half a book of gold may be blown out, one leaf at a time; each one being carefully turned, until it lies nearly flat, when, by puffing gently as near as possible on the centre of the leaf, it will become smooth and even, and must be cut into strips, with a knife used for the purpose, according to the widths of the different members and mouldings, and then be laid on with the tip. As the work advances, or when it is gilt all over, the gold must be pressed close with a little cotton; then, be brushed over with a dry, soft, hog's-hair brush, in order to clear away any loose particles of the gold-leaf—one previously used a little in the whitening, will best answer the purpose. If any defective parts appear, those which cannot be mended by pressing upon them the loose gold just brushed off,—which may be done with the brush in hand, or a little cotton,—must be covered in the following manner. Cut a leaf of gold into square pieces, proportioned to the sizes of the defects; and with the camel's-hair pencil, slightly moistening the tip of it, by putting it to the lip, place a piece on each faulty part, which must be again pressed with the cotton. The work is then finished, unless the faulty parts are too dry to receive the gold; when they must be again gold-sized and gilt, as before directed. In general, boys do not acquire the method of using the gold on the cushion, in less than three months; though a person determined to accomplish it, may do so in one week.

Oil-Gilding not to stand the weather.

Picture-frames, and other work in oil-gilding not intended to be exposed to the weather, to be well done, must be prepared, as far as smoothing, in the same way as work to be gilt in burnished gold. When smooth, and after being rubbed with glass-paper, it must be coated twice over with size, rather weaker than that used for whitening;—that which is stale, answers best. The gold-size must be laid on as before directed in oil-gilding; and when the work is gilt, it they must be filled up, evenly, with a putty made of strong size and whiting: the rest of the process is the same as after *smoothing*, in both cases.

To Gild Paper in Burnished Gold.

It must be tacked to a board by each corner, and then be gold-sized and gilt. It must be burnished on a piece of plate-glass, bedded in glazier's putty, or on a clean polished marble slab.

To make Oil Gold-Size.

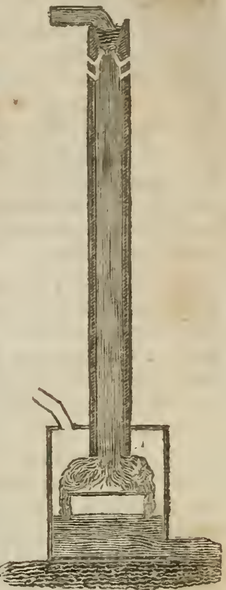
Put as much linseed-oil into a broad earthen vessel as will cover the bottom an inch deep, and add to it four or five inches in depth of water: let the vessel be exposed to the weather for three or four weeks, occasionally stirring them up, till the oil appears of the consistence of treacle; it must then be separated from the water, be put into a long bottle, or into a separating funnel used by the chemists, and be placed in such a degree of heat, as will render it perfectly fluid; the clear part should then be poured off, and it will be fit for use. Take any quantity of the best, yellow, stone-ochre, and a fourth part of white-lead; mix them with the oil on a flag-stone, using a mullar and pallet-knife: this mixture is oil gold-size; it must be put into an earthen vessel; and be covered with water, to prevent it from skinning.

On the Blowing of Air into Furnaces, by a fall of water. By the late WILLIAM LEWIS, M. D.

[CONTINUED FROM PAGE 193.]

In Dauphiny, in France.—The blowing machines used in Dauphiny, for the forgesand smelting furnaces, have a great resemblance, in their general structure, to the foregoing. They are described by Swedenburg, in the second volume of his *Regnum Subterraneum*, but with little exactness: a more accurate description, and figures of them, taken from the papers left by Reaumur, are inserted in the *Art des Forges et Fourneaux à Fer*, published by the direction of the French Academy.

The upright pipe, in the figure, is generally between twenty-five and twenty-six feet high: it is composed of two pieces of fir, hollowed and joined together by iron work. Instead of a distinct reservoir or funnel on the top, a part of the pipe itself is hollowed, so as to perform the same office: at the top it is twelve inches and a fifth in diameter, (English measure,) from thence it grows narrower, to the depth of nearly thirty-four inches, where its width is only about three inches and three-quarters; immediately below this part, called the choak, its cavity widens to nearly eight inches and a half, and this width it preserves throughout the rest of its length. Under the choak are ten air-holes, six of which are in one horizontal plane, at equal distances from one another, and the rest are about three inches and three-quarters lower down: all the holes are cylindrical, near two inches in diameter, and cut at such an obliquity, that the orifice of the upper ones is, on the inside of the pipe, eight inches; and on the outside only five inches below the choak.



The tub, or air-vessel, which receives the lower end of the pipe, is five feet and a half, or a little more, in depth, and nearly as much in width: the pipe enters into it about seventeen inches: about the middle of its height, is a flat stone or iron-plate, supported by cross bars of wood. The air passes off, as already mentioned, through a pipe inserted into the upper part of the tub, and the water through a hole at the bottom: on the outside of this hole is fixed a wooden frame, with an upright slider, by which the aperture for letting out the water may be occasionally increased or diminished. The blast is regulated, and the air suffered to escape, when it is not wanted, by a hole in the blowing pipe, to which is fitted a valve or stopper.

One of these machines is said to be sufficient for the forge, or iron finery: and two or three for the furnace in which the iron ore is run down.

In Foix, in France.—In the county of Foix, the blowing machines, as described by Reaumur, in the "*Art des Forges,*" above quoted, are considerably different from the foregoing. The pipe is rectangular, and the part above the choak divides into three funnel-shaped partitions. On the top is a reservoir, or cistern of water, and two of the partitions, close on all sides, pass up above the surface of the water, for carrying down air, and thus supplying the place of the lateral air-holes: the water enters into the third partition, which is the only space between the two foregoing, and which has but two sides, formed by the two opposite sides of the others.

The author makes the principal difference of these machines from those of Dauphiny, to consist in this disposition of the upper part; but the plate annexed to his description, shows another, which is, perhaps, more material to the success of the instrument. The whole height of the pipe, including that of the water in the reservoir on the top, is, according to the scale, twenty or twenty-one feet; and the choak, or narrow throat, is almost down to the middle of this height, so that the water issues through the choak with a velocity which it acquires from a pressure of about ten feet, which is greater than in the machine of Dauphiny in the proportion of about eleven to six: the quantity of water seems, also, to be much less, in proportion to the width of the pipe; the great pressure, probably, occasioning it to spread, so as to fill a larger bore than it could do when falling with less velocity.

Two pipes, divided in the same manner at the top, are fed by one reservoir: the lower ends of the pipes enter into one large oblong box, from which the air and water pass out, as in the foregoing machines described.

At St. Pierre, in Languedoc.—M. Barthes, in a curious paper, printed in the third volume of the "*Correspondence of the French Academy*," gives a minute description, though, in some respects, not so clear as could be wished, of a blowing machine at the forge of St. Pierre, on the river Obriou, which he looks upon as one of the most perfect of the instruments of this kind. Its general structure is nearly the same with that of Foix, but the height of water above the choak much less.

The upright pipe is square, about nine feet high, and somewhat more than seven inches wide. Into its top are inserted, at opposite sides, two pyramidal air-pipes, widening upwards, and passing up obliquely through a basin of water four feet high. The space included between the pipes, at their lower ends, under the basin, is a kind of hopper, into which the water enters through two apertures in the bottom of the basin: to each of these apertures is fitted a piston or stopper, hung to the end of a lever, by which it is raised, more or less, according as more or less water is required. Two of these instruments are furnished with water from one basin; and the lower ends of both enter into one air-vessel, which is near five feet high, about six and a half long, near three and a half wide at one end, and not quite two at the other. The stones for the water to fall upon are somewhat less than four inches and a half distant from the pipes: the water runs off through two rectangular apertures at the bottom, each about eight inches and a half wide, and near six inches high: the pipe which carries off the air is an inch and a quarter in diameter at the small end, where it enters the furnace.

The obscure part of the description relates to the hopper, and the apertures by which the water is discharged from it into the perpendicular pipe. The hopper seems to be divided into two rectangular openings, through which the water runs into the two hoppers, each of them about seven inches and a half long, and in width five inches and a half, measured on the level of the bottom of the reservoir, which is reduced to four and a half at the extremities of the air-pipes, where the hopper also terminates.

The author observes, that in this machine the water issuing from the hopper is necessarily reduced into drops. To satisfy himself more fully of this particular, he took a tin vessel, eight inches and a half square, and six and a half high; in the middle of the bottom he cut a rectangular opening, about an inch and a tenth long, and eight inches wide: to the two long sides of the slit he soldered two tin plates, inclined towards one another, and a third across them. These apertures, he says, represent those of the machine, when the stoppers are drawn up; and water put into this vessel, came out always, during the whole time of its running, in streams, which struck against and crossed each other; and which, after spreading, were reduced into drops.

In this illustration of the machine, however, it seems clear, there must be something which escapes my apprehension. Having cut an aperture of the above dimensions, in the bottom of a vessel, I fitted to each of the larger sides a plate, half the width of the aperture; both of which plates were moveable, and kept at different inclinations by means of a third plate, which passed across the middle of the two. The vessel being filled with water, I could not observe, as indeed was expected, the least crossing of the streams that ran through it: on the contrary, greatest part of the water issued in two opposite directions, horizontally, from between the ends of the plates.

[TO BE CONTINUED.]

Description of the manner of Polishing and Silvering Plates for Looking-Glasses, as practised in Paris.

[CONCLUDED FROM P. 148.]

Fourth operation. After the third operation, the plates are again examined. By holding them up to the light, it is seen whether they have any defects, such as flaws, air bubbles, or cavities. If they have any cavity which may be taken away by fresh grinding, they are again laid upon the table, and ground; but, if the cavity is so deep that it cannot be taken away in that manner, without consuming a great deal of time, and rendering the plate very thin, the plate is cut into various pieces, in the same manner as is done when it has originally any defect of consequence. These pieces, which are always left as large as possible, serve to make looking-glasses of a smaller size: but, in that case, the whole of them sell for much less than they would have sold for if they could have been kept, without defects, in one piece. When the plates have been examined, as before mentioned, they are made perfectly square; the sharpness of their edges is also taken off, by rubbing a piece of glass against them, so as to give them a kind of bevel.

They are then ground afresh, in the manner before described, by rubbing them with plates of glass, fixed in frames furnished with handles; but, instead of sand, emery (a sort of red oxide of iron) is made use of: it must be finer and finer, as the work advances, and no less than four kinds of it (of different fineness) are used. When the plates are perfectly smooth, they are to be rendered brilliant, the manner of doing which I shall now describe.

Fifth operation. The plate is laid upon a woollen cloth; but it is first coloured red on the under surface, that the degree of transparency and brilliancy may be perceived. It is then covered with a powder, which the workmen call *Rouge d'Angleterre*, composed of the residuum from the distillation of aqua fortis,* mixed with vitriol of iron and common salt. In this mixture, a decomposition takes place: the sulphuric acid of the vitriol of iron combines with the soda of the common salt, and the oxide of iron is separated. By washing the mixture, the muriatic acid. of the salt (which has perhaps dissolved a certain portion of the oxide of iron) is taken away, and also the sulphate of soda which is formed. The essential part of the above mixture seems to be the oxide of iron: in fact, emery, which is commonly used for polishing, is an oxide of iron. The residuum of aqua fortis contains oxide of iron, an additional quantity of which is produced from the mixture of vitriol of iron and common salt. But these oxides are in a state of greater division than emery; and the clay, being of a soft nature, also helps to render them less rough; they therefore wear the glass less, and, of course, polish it to a higher degree, than emery. When the plate is covered with the powder above mentioned, the workman has a sort of brush, the bottom of which consists of a kind of felt or velvet, and the top projects on each side, so that the workman can lay hold of it with both his hands. Having covered the brush with the powder, he rubs the glass with it: but, as it is necessary that a continual pressure should be applied, which would be very fatiguing, a kind of spring is made use of, three or four feet long, made of a piece of flexible wood, rendered still more elastic, and less liable to break, by means of cord, or of parchment. At one end of the wooden spring is an iron point, rather blunt, which presses above against a board suspended over the head of the workman, and enters into the board a sufficient depth to prevent its slipping; but not so much as to occasion any difficulty in changing its place. The other end of the spring, (which is covered with skin, that it may be laid upon the glass without danger, when the brush is taken off,) fits into the handle of the brush, but is not fixed to it, as it is necessary that the brush should be easily taken off, when a fresh quantity of the composition is to be applied upon it. By means of the above contrivance, the workman has nothing to do but to push the brush backwards and forwards, without being obliged to press upon it. It must, however, be evident, that there is a point upon which the spring (being there most bent) presses with most force, in consequence of which, the plate would, at that part, be worn hollow. To avoid this, the workman places the spring in such a position that its greatest pressure is upon the middle of the plate: he then begins to make use of his brush, passing it most frequently over those parts on which the spring presses with least force; by which means, every part is equally polished. In order that the brush may leave no traces of its course upon the plate, the workman takes care to move it in all directions. When the glass is thought to be sufficiently polished, it is placed upon a carpet of a dark green colour, which shows whether all the parts have the same degree of brilliancy. Those parts which have not been sufficiently polished appear whiter; they are marked, and the workman goes over them again.

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* The distillers of aqua fortis make use of a clay which contains a great deal of pyrites, or vitriol of iron: with this they mix nitre, and proceed to distillation. A part of the nitric acid is decomposed, which gives its oxygen to the sulphur of the pyrites, and thereby causes it to pass into the state of sulphuric acid. This acid combines with the potash, (another constituent principle of the nitre,) and the nitric acid, expanded by the heat, rises in distillation. The residuum then consists of (first) sulphate of potash, (secondly) oxide of iron, produced by the decomposition of the pyrites, and (thirdly) clay. By washing this residuum, the sulphate of potash is taken away.

It has been proposed to make use of machines for polishing plates of glass. This would indeed save a great deal of hand-labour, but a machine acts uniformly, and, as it were, blindly; whereas, a workman sees those parts of the plate which stand most in need of his labour and attention. Sometimes, in consequence of the roughness of the plate in certain parts, such a degree of friction is produced as makes it necessary to proceed more gently with the work. A machine acts always with the same degree of force, from which there would arise great danger of the plates being broken. It would therefore be hardly possible to make use of machines for the first or second operation; but I think they might be advantageously employed for the third and fourth. Such machines have already been described and executed.

Manner of Silvering the Plates.

This operation is performed upon a large table of stone, or of very thick wood, perfectly smooth and flat, and covered with gray paper, thoroughly stretched: the table is moveable on an axis, in order that it may be inclined, so as to cause the mercury to run into a groove made round the table. On this table is spread a sheet of tin-foil, well cleaned, and which has been hammered after being laminated. The workmen think it is necessary the tin-foil should be hammered, probably because, by being hammered in all directions, its texture is made more equal than it is left by the rollers, which, by stretching it more one way than the other, are apt to render it fibrous. A small quantity of mercury is poured upon the sheet, and spread all over its surface, so as just to moisten it. A larger quantity is then poured on, enough to cover the sheet to a certain thickness; which thick ness is always the same, and amounts to some lines. This requires some explanation.

There are certain substances to which mercury has more affinity than to others. When this affinity is much less than that of its particles to each other, it adheres a little to these substances, but does not spread over them, or sink into them. Of these substances, it is said, that they are not *moistened* by the mercury. (What is here said of mercury may be applied to any other liquid substance.) If a small quantity of mercury is poured upon a substance of this nature, which has a surface perfectly flat and horizontal, it evidently preserves a spherical form, provided the globule is so small that its weight is not sufficient to overcome the force which keeps all its particles arranged in the form of a sphere, round a common centre. If more mercury is added, until a depression is perceived upon the surface of the globule, and the height or vertical diameter of this flattened sphere is measured, it will be found that, whatever quantity of mercury is afterwards added, the height or diameter of the globule cannot be increased; but the mercury will spread itself horizontally, and always in a circular form, until the circumference of the circle extends to the edge of the surface upon which it lies: it will then run off, supposing it to have no affinity, or very little, with the substance upon which it is poured; that is, if it is poured upon the middle of a square surface, it will not extend itself into the angles thereof, but will run off as soon as it has reached the sides. But if, on the contrary, a small quantity of mercury is poured upon the substance with which it has sufficient affinity to become moistened by it, the following circumstances take place. First, it will be seen that the globule is less thick, because its affinity with the substance (being equal to a force pressing on it) produces a depression at the top of the globule. Secondly, it will cover the whole surface of the substance; because, supposing, as before, the surface of the substance to be square, it will not (when it has arrived at the edges of the square) tend to spread any farther, except by its weight; whereas, towards the corners, it will tend to spread farther, both by its weight and by its affinity with the substance. Thirdly, when it has covered the whole surface, it will not immediately run over, because it will still be a little retained by its attraction for the substance, so that a small quantity of mercury may yet be added, without causing it to run over; a circumstance which gives a little latitude to the workman. Hitherto, the mercury remains of the same height upon the tin-foil, which height can only be increased, in a small degree, towards the end, and varies according to the degree of its affinity with the substance on which it is poured. It is evident that it must depend, first, upon the adherence of the particles of the fluid with each other. Secondly, on the specific gravity of this fluid. Thirdly, on its adherence to the substance on which it is put. The height above mentioned may be taken by observation: the specific gravity of the fluid is also known; and tables have been given, by different philosophers, of the adherence of mercury, and that of other fluids, to various substances. If their formulæ are exact, it is clear that nothing remains unknown, except the adherence of the particles of the fluid to each other, which may be found by means of the data above mentioned. Or, if the adherence of the particles of the fluid to each other were known, that of the fluid to different substances would be obtained.

When the sheet of tin-foil is covered with mercury, the application of the plate of glass to it must not be too long delayed, because, in that case, the mercury would dissolve the tin-foil. As the surface of the mercury always becomes a little calcined, or may have acquired a little dust, or other foreign substance, a small quantity of water is poured upon it; and, when the plate is about to be laid on, a brush, and afterwards a hare's foot, is passed over it, which entirely removes the calcined pellicle, &c. A band of parchment, extending some lines above the surface of the mercury, is put upon the edge of the table; and the plate, being first made very clean and dry, is slipped over the parchment. It is necessary that the plate should sink a little into the mercury, that the air may not get between it and the metal; but great care must be taken that it does not sink too deep, because, if it should touch the sheet of tin-foil, it would tear it. The management of this part of the process is more easy than might be supposed; for the glass plate, being of less specific gravity than the mercury, would float upon it, consequently, to make the plate sink a little into the mercury, nothing more is necessary than to press upon it. When the plate is properly placed upon the tin-foil, (which ought to extend on every side a few lines beyond the plate,) the table must be gently inclined: a great part of the mercury then runs off, and the plate comes in contact with that part which adheres to the tin-foil. A short time after, the plate is covered with a woollen cloth, and several weights are laid on it, to increase its adherence to the tin-foil. When it has been in this situation a sufficient time, the projecting edges of the tin-foil are cut off, and the plate is taken up.

Mercury has some adherence to glass; and, if it does not moisten it, it is because the adherence of its particles to each other is greater than that of those particles to glass. But, in the present case, the mercury, being fixed by the tin, no longer tends to run into globules, but adheres to the glass, particularly when there is no air between them. By its means, the tin-foil adheres strongly to the glass; in the same manner as, by the help of water, the laminæ of crystals (those of sulphate of lime, for instance,) adhere to each other. The mercury alone here acts as a mirror. If it is taken from the glass, it generally appears to be covered with a white pellicle; and, when looked into, reflects objects more perfectly than the best looking-glass. The glass, therefore, only serves to prevent the mercury from being calcined, and causes its surface to be always perfectly even. As it is necessary that the rays of light should pass through the glass, to be reflected by the mercury, and that they should pass it a second time, to come to the eye, it must be evident that the glass ought to be perfectly even, transparent, and colourless. The tin serves only to lay hold of the mercury, and to fix it against the glass; for, by laying a plate of glass upon mercury, or by inclosing a small quantity of that fluid between two plates, a looking-glass might be made, which would act exactly like the others, but would be more heavy, and less convenient for moving from place to place.

OF CLOCK AND WATCH MAKING, AND OF THE METHOD OF DIVIDING THE DAY AT DIFFERENT PERIODS OF TIME.

[Continued from p. 154.]

The invention of Clocks moved by wheels and weights, and their progressive improvement till the middle of the seventeenth century.

THE inventor of clocks moved by wheels and weights, as well as the period of the invention, is totally unknown. The researches of learned men on this subject, however, refute the opinion of those who make the invention to be not older than the 14th century. The invention, however, was not very great, as the more perfect water-clocks were, before that period, furnished with wheels, so that the only improvement was the substitution of a solid body to act as a moving weight, instead of water. The principal point was to produce uniformity in the action of these weights; and in this respect the first clocks moved by weights were deficient till the time of Huyghens. It is not, therefore, to be wondered at, that the application of weights to clocks as a moving power, should excite so little attention as to be scarcely thought worth notice by cotemporary writers: water and sand were indeed more convenient than a solid weight, which requires too much room for its motion. The author is of opinion that the origin of clocks with weights is as old as the 11th century, and adduces very probable grounds in support of it; but it is not properly ascertained, whether the inventor was an European or a Saracen. The oldest complete clock moved by weights, of which there is any certain testimony, is that sent by the sultan of Egypt, in the year 1232, to the emperor Frederic II., the value of which was at that time estimated at 5000 ducats. In the 13th century many of the church steeples in Italy, were furnished with clocks, which were moved by weights, and which struck the hours. About the same time, the well known clock-house at Westminster-hall was furnished with a clock that struck the hours; the expense of which was defrayed by a fine imposed on one of the judges. The clock moved by weights of the abbot Richard of Wallingford, which by many has been considered as the oldest, was constructed in the 14th century. In the year 1394, Padua obtained the first clock, supposed to have been constructed by the celebrated philosopher, physician, astronomer, and mechanist, James Dondi. That such clocks might be introduced into England, Richard III. gave a patent to three Netherlanders, in the year 1368. Courtrai in France had a clock that struck the hours, so early as the year 1332: it was carried away in that year by Philip the Bold of Burgundy, and conveyed to Dijon, where it is still to be seen. The first large clock at Paris, was erected in 1364, by a German artist, Henry von Wick, who received daily, six French sous, together with free lodging in the tower of the Palais, to which the clock was removed in 1370. Bologna obtained the first public clock in 1356; Pavia, in 1402; Breslaw, by Schwelbelin, in 1368; Strasburg, in 1370; Augsburg, in 1398; Nuremberg, in 1462; and Venice in 1497. The first clocks were expensive, and many cities, desirous of having such machines, were not able to raise money to purchase them. In the year 1523, the fines levied from the students at Oxford, were employed to defray the expense of the clock erected on the church of St. Mary. Private individuals, however, about this time, began to obtain clocks. The first instance of a clock with weights, being employed for astronomical purposes, occurs in 1484, when Walther, as he says, with a well regulated clock, made an observation on Mercury. Tycho had three of these clocks, which showed minutes and seconds: he found, however, that they were exposed to variations, from the influence of the atmosphere and wind; on which account, he caused to be constructed a quicksilver clock, in which distilled quicksilver, instead of sand and water, showed minutes and seconds. To produce a uniform fall, so much quicksilver dropped from another vessel into the hour-vessel, as was sufficient to keep it always at the same height. As the study of astronomy required more accurate measurers of time, we are indebted to that science for the improvement of these instruments, the construction of which does so much honour to the human genius.

Invention of Watches and Table Clocks.

Hele, of Nurnberg, is generally considered as the inventor of watches, or spring-clocks, as they ought properly to be called; the first of which he is said to have constructed in the year 1500. According to others, Halbrecht of Strasburg was the inventor: but his first clock was constructed in 1520, and consequently twenty years later than Hele; who, it is certain, made small spring-clocks or watches so early as 1500. Nurnberg and Augsburg were the first cities of Germany, in which watches were made. Hele's watches not only indicated the hours, but struck them also. Andrew Heinlein, who trod in Hele's footsteps, made small clocks in the smelling-balls which were used in his time. In the architectural office at Augsburg, there is a watch, above 200 years old, which strikes the hours: it is contained in a crystal case, and was made by Buschman. There were striking watches in France, in the time of Louis XI. The oldest watch in England, that goes still pretty well, is of the year 1540, and is preserved in the palace of Hampton Court.

Invention of the Fusee, Pendulum, and Spiral Spring.

The fusee was, in all probability, invented in England, about the end of the 16th century, by whom, it is not known, and was thence introduced into Germany. It was examined geometrically by Varignon and De la Hire, in order to determine the most advantageous form; which, however, does not always avail, on account of the inequality of the spring, and, therefore, advantage is taken of other mechanical means: of this kind is the balance, by means of which the power of the spring can be adjusted, and which undoubtedly was invented in Swisserland about the beginning of the 18th century. In the first watches with fusees, the diameter was small, and the box large and broad. The catgut, by which it was wound up, passed eight or nine times around the fusee. This made the watch clumsy and ill-shaped. The catgut, however, was soon exchanged for a chain, which consists of small plates of steel, united together with great labour. In the middle of the 17th century, Huyghens invented a better method of regulating the movement of clocks. In the year 1657, he applied the pendulum as a regulator to large clocks moved by weights; and, some years after, recommended the balance spring for watches. Before that period, some had used, instead of the spoon-formed balance, one in the form of a ring, or employed a small fly wheel; and Hautefeuille used at first a swine's bristle, and then a weak, straight, steel spring, for regulating the balance. In the year

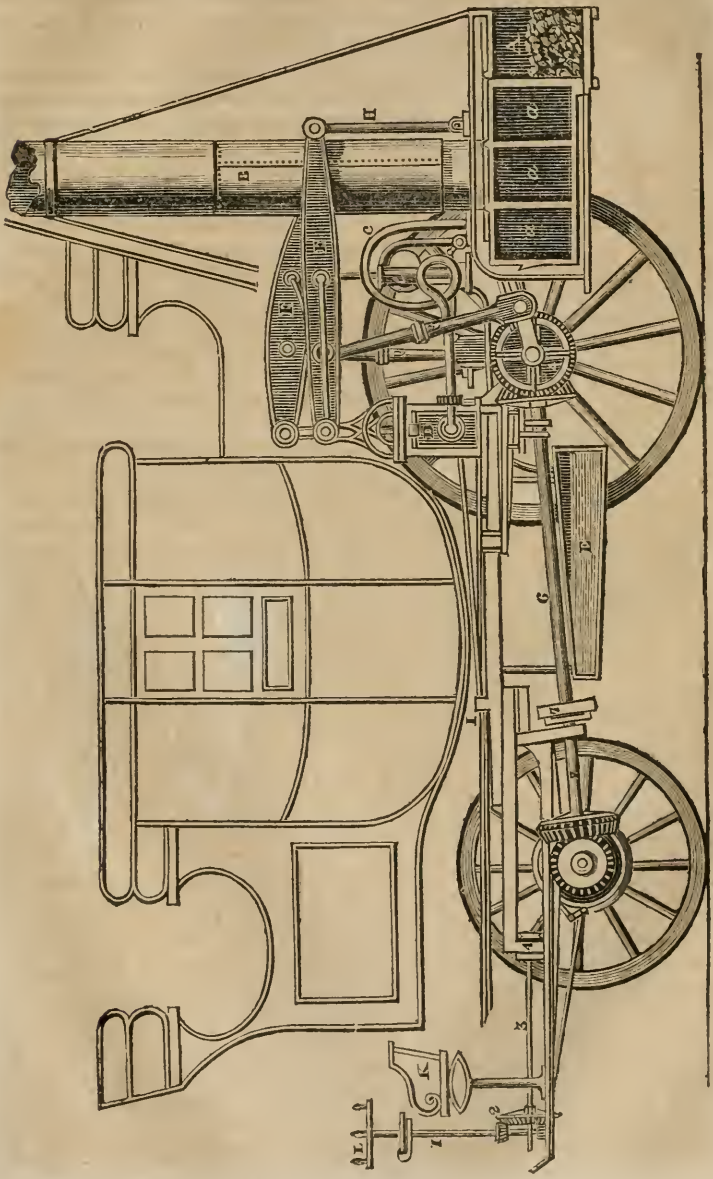
1674, Huyghens caused a watch with a spiral balance spring to be constructed by Turet at Paris. Dr. Hook entered into a dispute with Huyghens in regard to this invention, and proved that he had invented such a watch for Charles II., which had the inscription *Robert Hook invenit* 1658, *Tompion fecit* 1675; and that he had solicited a patent for such watches in 1660, but did not obtain it till 1675.

ENGLISH PATENTS.

Account of the Locomotive Steam Coaches invented by Messrs. Burstall *and* Hill, *described under two Patents.* Enrolled, August, 1825, and June, 1827.

The *first* effort of Messrs. Burstall and Hill, to attain that important desideratum, of rendering steam power available for propelling carriages on ordinary roads, was the subject of a patent enrolled nearly two years ago. The description of their original plan is, however, necessary, as the inventors have, in their late patent, retained the greater part of the arrangements contained in the former,—these are as follow:

A, represents the boiler, which is formed of a stout cast-iron or other suitable metal flue, inclosed in a wrought-iron or copper case, as seen in section, where A is the place for fuel, and *a a a* are parts of the flue, as seen in section; the top being formed into a number of shallow trays, or receptacles for containing a small quantity of water in a state of being converted into steam, which is admitted from the reservoir by a small pipe. B is the chimney, arising from the centre flue; at D are the two cylinders, one behind the other, which are fitted up with pistons and valves, or cocks, in the usual way, for the alternate action of steam above and below the pistons. The boiler being suspended on springs, the steam is conveyed from it to the engines through the helical pipe, *c*, which has that form given to it to allow the vibration of the boiler without injury to the steam joints. E is the cistern, containing water for one stage, say 50 to 80 gallons, and is made of strong copper, and air-tight, to sustain a pressure of about 60 pounds to the square inch. At *e* is one or more air pumps, which are worked by the beams, F F, of the engines, and are used to force air into the water vessel, that its pressure may drive out, by a convenient pipe, the water into the boiler, at such times, and in such quantities as may be wanted. The two beams are connected at one end with the piston-rods, and at the other with the rocking standards, H H. At about one-fourth of the length of the beams from the piston-rods, are the two connecting rods, *g g*, their lower ends being attached to two cranks, formed at angles of 90° from each other on the hind axle, giving by the action of the steam, a continued rotatory motion to the wheels, without the necessity of a fly wheel. The four coach-wheels are attached to the axles, nearly as in common coaches, except that there is a ratchet-wheel formed upon the back part of the nave, with a box wedged into the axle, containing a dog, or pall, with a spring on the back of it, for the purpose of causing the wheels to be impelled when the axle revolves, and at the same time allowing the outer wheel, when the



carriage describes a curve, to travel faster than the inner one, and still be ready to receive the impulse of the engine as soon as it comes to a straight course.

The patentees have another method of performing the same operation, with the further advantage of backing the coach when the engines are backed. In this plan the naves are cast with a recess in the middle, in which is a double bevel clutch, the inside of the nave being formed to correspond. These clutches are simultaneously acted upon by connecting levers and springs, and which, according as they are forced to the right or left, will enable the carriage to be moved forward or backward. To the fore naves are fixed two cylindrical metal rings, round which are two friction bands, to be tightened by a lever, acted upon by the foot of the conductor, and which will readily retard or stop the coach, when descending hills. K is the seat of the conductor, with the steering wheel, L, in the front, which is fast on the small upright shaft, 1, and turns the two bevel pinions, 2, and the shaft, 3, with its small pinion, 4, which, working into a rack on the segment of a circle on the fore carriage, give full power to place the two axles at any angle necessary for causing the carriage to turn on the road, the centre of motion being the perch-pin, I.

The fore and hind carriage are connected together by a perch, which is bolted fast at one end by the fork, and at the other end is secured by two collars, which permit the fore and hind wheels to adapt themselves to the curve of the road.

To ascend steep parts of the road, and particularly when the carriage is used on rail-ways, or to drag another behind it, greater friction will be required on the road than the two hind wheels will give, and there is, therefore, a contrivance to turn all the four wheels. This is done by the pair of mitre-wheels, 4, one being on the hind axle, and the other on the longitudinal shaft, 6, on which shaft is a universal joint, directly under the perch-pin, I, at 7. This enables the small shaft, 7, to be turned, though the carriage should be on the lock. On one end of the shaft, 7, is one of a pair of bevel wheels, the other being on the fore axle, which wheels are in the same proportion to one another as the fore and hind wheels of the carriage; this causes their peripheries to move on the ground at the same speed.

The patentees, by a peculiar construction of a boiler, intend to make it a store of caloric; they propose to heat it from 250 to 600 or 800 degrees of Fahrenheit: and by keeping the water in a separate vessel, and only applying it to the boiler when steam is wanted, they hope to accomplish that great desideratum in the application of steam to common roads, the making just such a quantity of steam as is wanted; so that, when going down hill, where the gravitating force will be enough to impel the carriage, all the steam and heat may be saved, to be accumulating and given out again at the first hill or bad piece of road, when, more being wanted, more will be expended.

The engines are what are called high-pressure, and capable of working to 10 horse power; and the steam is purposed to be let off into an intermediate vessel, that the sound emitted may be regulated by one or more cocks.

From the foregoing description we think we are warranted in saying that there is a considerable degree of ingenuity, as well as originality, in many of the details, and also in the general arrangement of the machinery. In this light, we regard their mode of allowing the several wheels to move simultaneously at different velocities, the convoluted form given to the steam and water pipes, (by which very simple means, the injurious effects of jolting are avoided,) and the mode of injecting water into the boiler, by means of compressed air.

By the *recent* improvements, the boiler is to be placed upon an additional pair of wheels, so that the whole machine may run upon six wheels instead of four. The patentees claim two distinct modes of employing this extra pair of wheels, either of which may be adopted. By the first mode, the back end of the boiler is bolted to the axletree of the extra wheels, and the front end rests and turns upon a pivot, fixed to the axle of the middle pair of wheels. By the second mode, the axle of the hind wheels turns upon a centre, and the boiler is attached to a frame, which encompasses it: this frame is suspended upon springs, or not, (according to the nature of the road,) the fore part of it being bolted to the axle of the middle pair of wheels; by either of these contrivances, the boiler and its carriage may be made to adapt itself to bends in the road, without incurring injurious strains.

The next improvement of material importance, consists in the construction of the steam pipes, which have sliding and moveable knee-formed joints, to admit of their extension or contraction, when the carriage is passing over rough, or undulating ground; thus constructed, the pipes also accommodate themselves to bends and irregularities in the road.

The third improvement relates to the mode of steering the carriage, which is effected by a chain circumscribing the steering wheel, the ends of the chain then passing round pulleys fixed on the carriage frame, are attached to the opposite extremities of the fore axletree.

Preparations are nearly completed for exhibiting this carriage, and its operation, in a piece of ground, engaged for that purpose.

[*Register of Arts.*

Description of the Patent Char-volant, or Carriage, to be drawn by Kites. Invented by Colonel James Viney, *of the Isle of Wight, and* George Pocock, Esq. *of Bristol.*—Enrolled, Oct. 1826.

In our number for February, we published some remarks upon the project of the patentees of the invention under notice, and now add a description of the kind of kite, and car, which they employ.

The patentees propose to attach to the car, or vessel, to be moved, the cords of one or more kites, according to the force of the wind, and the resistance to be overcome. The kite, *a*, fig. 1, is jointed in the middle, that it may be folded up, and carried, or stowed away with greater facility, and that it may be adjusted so as to present to the wind a surface of any required dimensions: this is effected by the four cords, *b b b b*, which are brought together by passing through the dead eye, *c*, whence they proceed to the car, and are arranged to the required lengths by the persons therein. The cords are also used for regulating the direction of the power, by shortening those on the right hand when the car is required to be turned to the right, and those on the left hand, when it is required to be turned to the left. But the char-volant, represented by fig. 2, is principally guided by the T handle, *e*, and stem, *e f*, which act on the axis of the fore wheels by means of an endless band, or cord, passing about the pulley, *f*, fixed on the lower end of the stem, *e f*, and the pulley, *g*, fixed on the bed of the axletree of the fore wheels. The machine is stopped, or its motion retarded, by the drag, *k*, which is attached to the perch, by a spring, to keep it off the ground, till the motion is required to be retarded, or the car stopped, when its fluke end is pressed into the earth by the lever, *h*, acting on the connecting piece, *i*.

Fig. 1

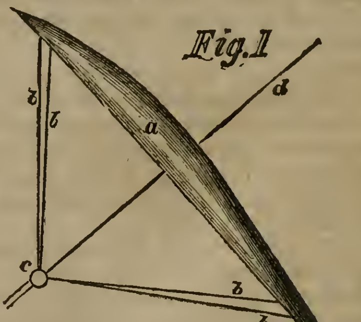
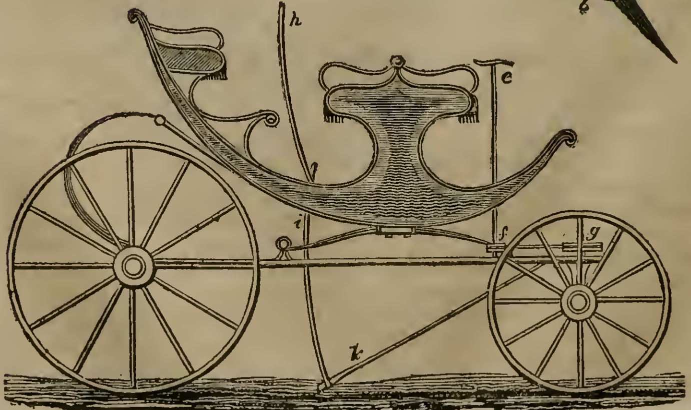


Fig. 2



When great power is required, two or more kites are placed in succession one behind the other, and so attached together by cords, that whatever motion or direction is given to one, will be communicated to the others.

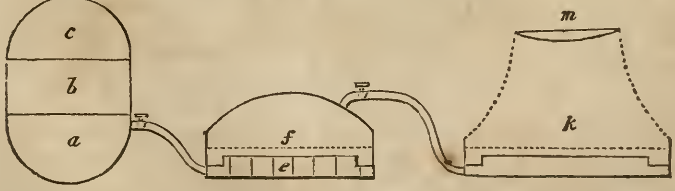
The patentees propose to attach, occasionally, to their car a platform on small wheels, for the purpose of carrying a poney, to be employed in dragging the machine, in cases where the kites cannot be applied.

The views of the patentees are not confined to the application of the power of kites to the moving of carriages upon land, but likewise to the sailing of ships, raising weights, and other purposes; but they do not describe in their specification their method of applying kites to raise weights.

We are aware that kites have been employed to assist in swimming, by Dr. Franklin, who considered that with such an aid a man might swim across the channel from Dover to Calais, and that attempts have been made to move both boats and cars by the same means. [*Ib.*

Account of the Patent Salt Pans, invented by WILLIAM JOHNSON, *of Droitwich.*—Enrolled June, 1827.

MR. JOHNSON employs steam of different degrees of heat, to produce the evaporation in pans entirely enclosed from the atmosphere, so that the vapour arising from the first pan, where the *fine salt* is produced, is employed in heating the second, where the *broad salt* is formed; and the vapour arising from the latter is employed, in like manner, to produce, in the third pan, *British bay salt.*



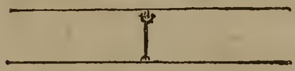
A sketch of the steam boiler is represented in the annexed drawing, divided into three portions, *a*, *b*, and *c*; and steam is generated in one or more of these divisions, according to the supply required. When the steam in *a* is raised to a pressure of twenty-five pounds on the square inch, that in *b* will be twelve, and that in *c* five pounds.

When only one of the divisions, *a*, of a steam-boiler, about seventeen feet by ten, is employed, it will heat pans to the extent of 2400 square feet up to 164° Fah. And when the three divisions, *a*, *b*, and *c*, are used together, an extent of 4300 square feet will be heated to the same temperature.

The steam is conveyed in a pipe from the boiler to a steam vessel *e*, under the fine salt pan *f*. This pan is made steam-tight, and the steam arising therein is conveyed by a pipe to a similar vessel under the broad salt pan *k*. Over the broad salt pan *k*, is placed the bay salt pan *m*, and the space between them is enclosed by thin boards, or other light material, to confine the vapour arising from *k*, in order to produce the required heat in the pan *m*. This pan is made lowest in the middle, as represented in the drawing, so that water condensed on its lower surface may be collected in one place, where it is received and carried off in a spout, to prevent its return into the brine in the lower pan *k*.

The patentee considers it of great importance to keep the bottom of the pans clear of salt, and for that purpose employs rakes, which are kept constantly in motion, by a steam engine. These rakes deposit the salt in receptacles at the sides of the pans. The rods by which the rakes are moved, pass through stuffing-boxes in the pans, to prevent the escape of steam. When there are many rakes in a row to put in motion, it is effected by a horizontal shaft from the steam engine, which by means of bevel gearing puts in motion a series of nuts, screwed upon the rake rods, by which the various rakes are made alternately to advance and recede.

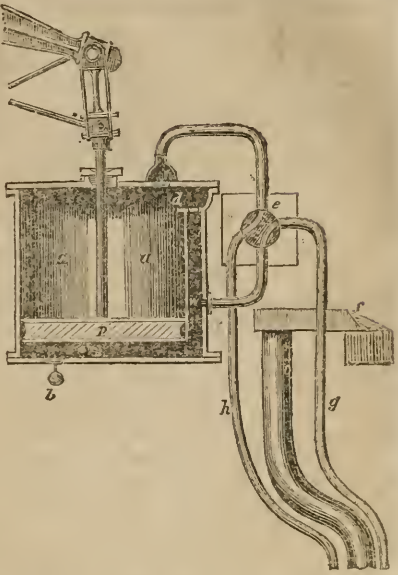
For the purpose of making the interior surface of the pans smooth, to facilitate the removal of the salt, the pieces of which it is composed are united by turning down the edges at right angles, and rivetting them together, as represented by the annexed sketch. The steam vessels under the pans are strengthened by a number of link bolts, attached to the joinings underneath the pans by a forked end, taking in the bent joinings; and to the bottom of the steam vessel, by being hooked to staples, as represented.



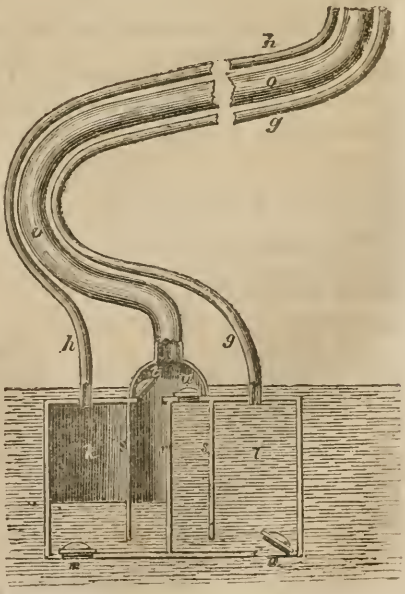
We have deemed it unnecessary to enter into a farther detail of Mr. Johnson's process of making salt, as it does not, in other respects, differ from the plan heretofore used by him, and for which he obtained patents in 1823 and 1824. [*Ib.*

Account of the Hydraulic Machine, for raising Water from Mines, or communicating Motion at a distance from the first mover. Patented by CHARLES SEIDLER, Esq.—Enrolled June, 1827.

THE patentee proposes to raise water from any depth, and through any straight or circuitous passage, by means of air communicated in pipes from the place where the pumps can be most conveniently worked to the reservoir, or place, from which the water is to be raised, in the manner represented in the accompanying figure: where *a a* represents a cylinder, in which a piston, *p*, works by means of a steam engine, or other power. *h g* are copper pipes, forming a communication between the cylinder, *a a*, and the cast-iron tank, or vessel, *k l; o o* is a large delivery pipe, of copper or other material, through which the water is conveyed from the tank and discharged; at *r* is an air-tight partition, dividing the tank into the two parts, *k* and *l;* and *s s* are two air-tight partitions, proceeding from the top nearly to the bottom of the tank: *e* is a two-way cock for effecting an alternate communication between *a* and *k*, and between *a* and *l*.



The other parts of the machine will be explained in the following description of its action. Suppose the piston, *p*, to be raised from its present position in the cylinder, the air above it will be conveyed through the valve *c*, and the pipe, *h*, into the vessel, *k*, and force the water contained therein through the valve, *t*, up the pipe, *o o*, while air will be supplied to the cylinder below the piston through the valve, *b*. When the piston descends, the air will pass from the lower to the upper side of it, by the valve, *d;* this operation is to be continued till all the water is forced out of *k*, when the two-way cock, *e*, must be turned, to change the communication through the valve, *c*, to the pipe, *g*, and the part of the tank, *l:* at the same time, the air which was forced into *k* will be permitted to re-enter the cylinder through the pipe, *w*, (as shown by the dotted lines in the cock,) *e*, so that no air will be required to enter at the valve, *b*, except at



the commencement of the operation, or when any of the air is discharged with the water, or otherwise dissipated. When the air is liberated from the receptacle, *k*, of the tank, it will be again filled with water through the valve, *m;* the valve, *i*, being shut by the pressure of the water in the pipe, *o o*. During this time the water in *l* will be forced through the valve, *u;* and in the same manner from *k*, through the valve *i*. The cock *e* is to be turned by the hand, or by the machinery, after such a number of strokes, of the piston in the cylinder, as is sufficient to displace the water in one division of the tank.

Mr. Seidler also proposes to put machinery in motion at any distance from the first mover, by raising a piston in a cylinder with air forced under it, which is permitted to descend by its own gravity, when the air is liberated, thus producing an alternating motion to be applied to any required purpose.

The patentee does not claim any thing new in the manner of working the pistons, valves, or cocks, but merely in his method of applying a column of air to produce the effects described.

There are many instances connected with mining and excavations of the earth, where water has to be pumped from depths considerably exceeding that to which atmospheric pressure will raise it, and where the localities of the place prevent the possibility of extending a piston rod from the place where the power can be applied to the water to be raised; and to all such cases this method appears to be applicable; for the pipes may be extended indefinitely, and in any direction to the place from which it may be necessary to remove the water. [*Ib.*

Account of the patent obtained by MARK LARIVIERE, *Machinist, for his Invention of a certain Apparatus, or Machinery, to be applied to the well known Stamp Fly-Press, or other Presses, for the purpose of Perforating Metal Plates, and for the application of such Perforated Metal Plates to various useful purposes.*

THIS invention is an apparatus to be applied to a fly-press, used for stamping holes in metal, and consists of a series of punches, which are to be brought into action at one time, instead of piercing the holes singly, as is the usual practice.

The fly-press intended to be employed in conjunction with this apparatus, does not materially differ from the ordinary press used for stamping holes in plates, or sheets, of metal, except in the construction of the piercer and matrix, the former of which is made with any desired number of punches. and the latter with a corresponding number of holes.

In order to form a correct notion of this invention, it is necessary to state, that the patentee's object is to stamp a multitude of small holes in a metallic plate, at equal distances apart, with extreme accuracy, and considerable expedition; which plates, when so pierced, are to be employed for sieves, and such other purposes as wire-gauze has been heretofore applied to.

When the holes are to be pierced in the sheet or plate of metal, in straight lines, a series of small punches are fixed in the lower part of the plunger of the fly-press, the bed or matrix fixed below, being perforated with corresponding holes, fitting very accurately to the punches; the sheet or plate of metal is then fastened by cramps to a sliding frame, which conducts it along under the punches. The fly of the press being now turned round horizontally as usual, the punches are brought down and forced through the plate or sheet of metal, producing the first row of holes; the pieces of metal falling down below: and the punches being raised again out of the holes, a winch connected to a worm-shaft, is turned round, which drives the sliding carriage forward, and advances the plate or sheet of metal sufficiently far to bring the plate into a situation for piercing the next row of holes, and so on, until the whole of the plate or sheet of metal is pierced full of rows of holes, at equal distances apart.

If the plates are to be perforated with circular ranges of holes, then a piercer with a suitable number of punches set in concentric circles is to be employed, and a matrix with corresponding holes fixed under it. In some cases, when a circular plate of considerable diameter is to be perforated, it will not be desirable to punch all the holes at once, but to employ a piercer and matrix, in which the punches and holes are ranged in the form of a quadrant, or sextant, or octant, or any other equally divided portion of a circle, and then after every operation, to turn the plate round by machinery, so that the piercers shall fall exactly along-side of the outer ranges of the preceding sector, and thus, by a succession of four, six, eight, or any other number of operations, the area of the complete circle shall be equally and entirely perforated.

It must be obvious, that for every differed arrangement of holes, different punches and matrixes must be employed, and thus plates or sheets of metal may be pierced with holes of any size and closeness, from that of an ordinary colander, to the fineness of gauze.

The patentee claims as a second feature of his invention, the application of the perforated metal plates, or sheets, to the making of sieves, lanterns, and all other kinds of utensils for which wire gauze has been heretofore employed.—Enrolled May, 1826.

[*Newton's Journal.*

Account of the Patent obtained by EZEKIEL EDMONDS, *Clothier, for his Invention of certain improvements on Machines for Scribbling and Carding Sheep's Wool, Cotton, or any fibrous articles requiring such process.*

THE improvements which constitute the subject of this patent, are simply variations in the arrangement of the card rollers belonging to a carding engine, of the construction commonly employed for straightening the fibres of wool and cotton.

The patentee has arranged these improvements under four heads. First, a mode of reducing the speed of the working rollers, at the back of the large cylinder. Secondly, an additional roller, which conducts the bands that lead from the preparing rollers to the working rollers, in order to increase the velocity of the former, and diminish that of the latter. Thirdly, a roller near the doffer, which catches any of the material that falls, and gives it again to the large cylinder. And, fourthly, a new arrangement of the working rollers, and the introduction of a small roller between every two of them, for the purpose of changing the direction of the fibres.

The small cylinder and its rollers, called the breaker, which receives the material in the first instance, from the feeding cloth, is made to revolve with great speed, for the purpose of breaking up, and preparing the material. The fibres are then received on to the periphery of the large cylinder, and as that revolves, are communicated to the first of the working rollers, on the back of the large cylinder; which rollers being actuated by a band from a small roller below, do not move so fast as in ordinary carding engines. The first working roller, as it goes round, gives the material, just received, to the intermediate roller, which delivers it to the second working roller, and that to the large cylinder again; the large cylinder then communicates it to the third working roller, and through its intermediate roller to the fourth, and again to the large cylinder, and so on, thus changing the direction in which the fibre is carded, and interrupting the speed of the operation; and any loose materials which may happen to have escaped from the cards, and be carried round by the large cylinder, is received by a roller near the doffer, and given to the large cylinder, to be operated upon.

Thus, it will be perceived, the improvement is founded merely upon a supposed advantage which may result from turning over the fibres of the wool or cotton in a different way to other carding engines, and in varying the speed of the several revolving rollers, in a different way to other carding engines, and not in any variation of the principles of a carding engine, or indeed, in its general construction.—Enrolled May, 1826. [*Ib.*

Account of the Carriage Step, patented by Ross Corbet, *of Glasgow.* Enrolled December, 1825.

This improvement is applicable to coaches generally, but is peculiarly adapted to those, of which, the proprietors do not employ a footman to open and shut the door and steps; as the act of opening the door causes the steps to be opened out, and that of shutting the door, shuts the steps up again. For this reason, it is presumed, that the invention will be found a great convenience to medical men, and stage coach proprietors. These steps are strong, without being clumsy;

and their operation, apparently, so smooth and easy, as to require no more force to open and shut the door, than is applied to open and shut a carriage door without this appendage.

In the annexed engraving, Fig. 1 is intended to represent the back view of a coach, on one side of which, the steps and door are both open, and on the other they are both shut. Fig. 2 gives a side view of the steps only, on a larger scale, and will enable the reader to understand their construction.

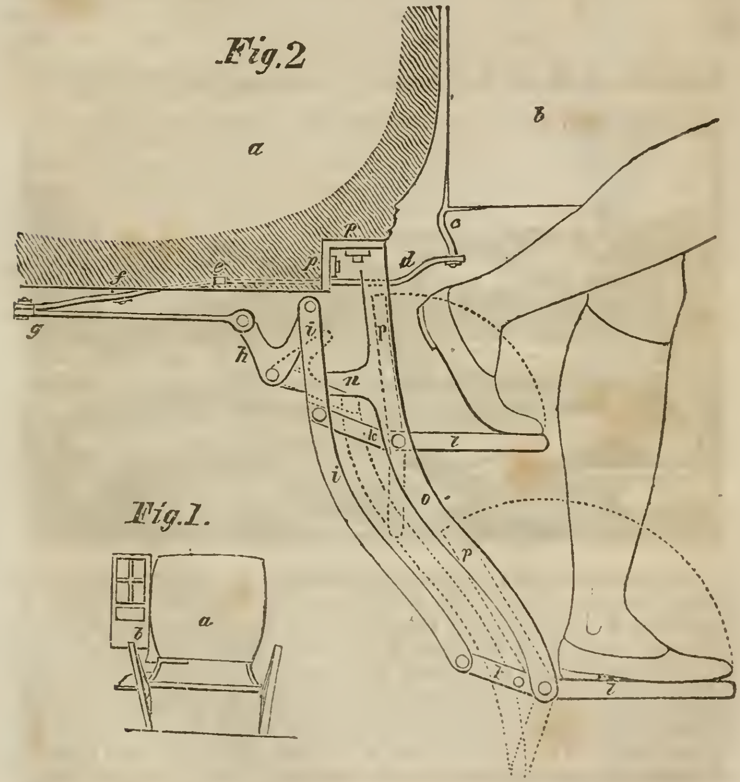


Fig. 2

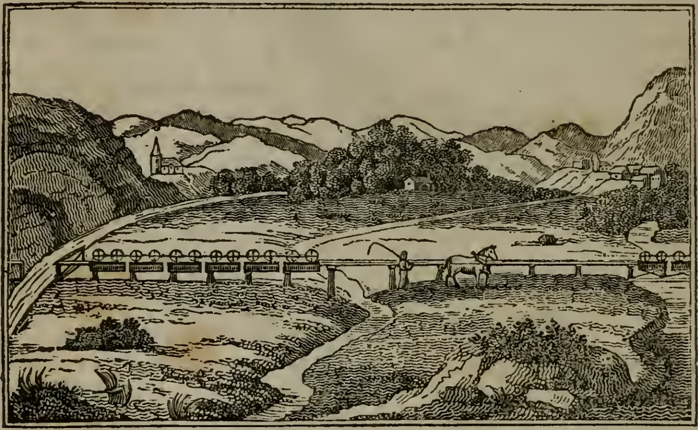
Fig. 1.

At *a* is the coach body; *b* a part of the coach door open; *c* is a bent iron fixed to the bottom of the door, connected to a curved rod, *d*, at the extremity of which is a joint, *e*, attaching it to the lever, *f*, which moves upon a fulcrum in the middle. At *g*, is another joint, by which, and an intermediate rod, it is attached to one of the horns of the crank, *h:* the other horn of this crank is connected by a joint to the long curved lever, *i i*, which gives motion to the short levers, *k k*, and these last being in one piece with the steps, *l l*, they move together. The long curved bar, *o*, (of which there are two, one on each side of the steps.) and its short branch, *n*, are fixtures; being bolted to the body of the carriage at *p p*.

A little attention to the train, and connexion, of the levers just mentioned, will show that the act of shutting the door of the carriage will cause the lever, *f*, so to change its direction, as that the crank, *h*, and consequently the bar, *i i*, will be thrown into the position shown by dotted lines; and that it necessarily follows, the steps will be forced into the situation shown by dotted lines, at *l l*.

[*Register of Arts.*

Description of Mr. H. R. PALMER'S *Patent Improved Iron Rail-way.*



THE accompanying engravings represent an improved construction of rail-way, by Mr. H. R. Palmer, civil engineer. Instead of *two* lines of rail laid upon the ground, as heretofore, Mr. Palmer's rail-way consists of only *one*, which is elevated upon pillars, and carried in a straight line across the country, however undulating or rugged, over hills, valleys, brooks, and rivers; the pillars being longer or shorter, to suit the height of the rail above the surface of the ground, so as to preserve the line of the rail, which is always straight, whether the plane be horizontal or inclined. The wagons, or receptacles for the goods, travel in pairs, one of a pair being on one side of the rail, and the other on the opposite side, as panniers over the back of an ass. By this arrangement, only two wheels are employed (instead of eight) to convey a pair of wagons; these two wheels are placed one before the other on the rail, and the axletrees upon which they revolve, are made of sufficient length, and strength, to form extended arms of support, to which are suspended the wagons or receptacles on each side of the rail, *the centre of gravity being always below the surface of the rail.*

A number of the carriages are linked together, and towed along the rail by a horse, as barges on a canal. Owing to the undulation of the country, the horse will sometimes be much below the rail, in consequence of which, he is provided with a sufficient length of rope, to preserve a proper angle of draught.

Fig. 1. is an end view of the carriage, with a cross section of the rail, and of a pillar showing its form, and manner of fixing. *Fig.* 2, is a side view of the rail-way passing over an uneven surface, with three of the supporting pillars of unequal length. Upon the upper surface of the rail, are seen the two carriage wheels, and the manner of suspending the wagons, or receptacles, from the axletrees, which is, however, better shown by *Fig.* 1, letters I, I, I, I, (the same letters refer to the same parts in the different figures.) *Fig.* 3, is a plan of the same, in which the comparative measurements and the mode by which the receptacles are braced together, are clearly shown.

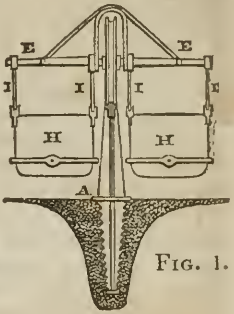


FIG. 1.

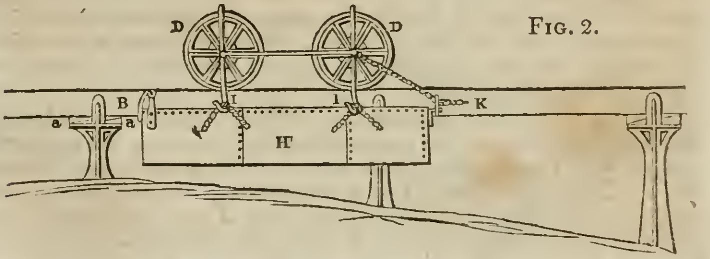
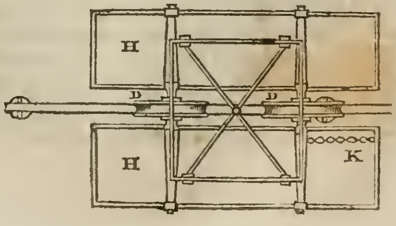


FIG. 2.

A, *Fig.* 1, is an upright pillar of cast iron, having at the shoulder a flanch which rests upon the surface of the ground. The pillar is formed with ribs, at right angles, which converge toward the lower extremity, and are notched on the edges, for the better securing it firmly in the ground, with the broken hard materials which are rammed around it; the hole into which it is inserted being previously well prepared by ramming with a sort of pile driving engine. Three of these pillars are seen at *Fig.* 2, which are placed at about nine feet apart. At the upper extremity of the pillars are long clefts, or openings, to receive the rail B, which is composed of deal planks set on their edges, with the upper surface C, defended by cast or wrought iron plates, a little convex on the upper side.

FIG. 3.



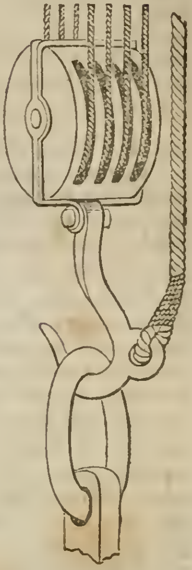
When the rail has been some time in use, and all has taken the proper bearing, a little adjustment of the line may be requisite, before the rail is bolted to the pillars; to effect which, a very simple and easy method is provided. In the cleft of the pillars, and under the rail, two wedges, a a, are introduced, whereby its level may be adjusted with the nicest accuracy.

D D are the wheels, which are provided with flanches on their peripheries to keep them from travelling off the rail. E E are the arms or axles, H H are the receptacles for the goods, which are represented as made of plate iron, and are suspended to the arms or axles (as before mentioned) by the inflexible rods I I I I. To one of the arms, a chain, K, is hooked, to which a towing rope may be connected. Any number of carriages may then be attached together by chains hooked on to the angles.

The landscape is intended to exhibit a portion of the rail-way in use, and the methods by which several of the obstacles which frequently present themselves, are overcome. On the left is seen a jointed rail, or gate, which crosses the road; over which the train of carriages have just passed, and the gate swung back, to leave the road open. The horse and man having just forded the brook, the train of carriages is proceeding in its course, and following another train part of which is seen on the right, crossing the rail-bridge, which is simply constructed for that purpose. Provision is made for trains of carriages that are proceeding in opposite directions, by means of "sidings" or passing places.

Among the principal advantages proposed from the adoption of Mr. Palmer's plan, may be mentioned, that of enabling the engineer, in most cases, to construct a rail-way on that plane which is most effectual, and where the shape of the country would occasion too great an expenditure, on former plans; that of being maintained in a perfectly straight line, and in the facility with which it may be always adjusted; in being unincumbered with extraneous substances lying upon it; in receiving no interruption by snow, as the little that may lodge on the rail, is cleared off by merely fixing a brush before the first carriage in the train; in the facility with which the loads may be transferred from the rail-way on to other carriages, by merely unhooking the receptacles, without displacing the goods, or from other carriages to the rail-way, by the reverse operation; in the preservation of the articles conveyed, from being fractured, owing to the uniform gliding motion of the carriages; in occupying less land than any other rail-way; in requiring no levelling or road-making; in adapting itself to all situations, as it may be constructed on the side of any public road, on the waste and irregular margins of rivers, on the beach, or shingles, of the sea-shore; in places where no other road can be made; in the original cost being much less, than in the ordinary mode; and in the impediments and great expense occasioned by repairs being by this method almost wholly avoided. [*Ib.*

Description of the Patent Cat-Block, invented by Mr. Thomas Hillman, *Millway.*



By the common method of catting an anchor, the anchor being once hooked by the cat-block, the whole process of catting and stopping the anchor, overhauling the cat-fall, and unhooking the block, must be performed before the anchor can be let go again; hence many ships navigate rivers, with the anchor hanging under water, which materially affects the steering of the ship.

By this plan, when an anchor is to be catted, the bite of the stopper is carried forward, to assist in conducting the cat-block to the ring of the anchor. When hooked, the anchor is catted in the usual manner, and the stopper being passed over a cleet at the end of the cathead, the slack of the stopper is taken up and belayed.

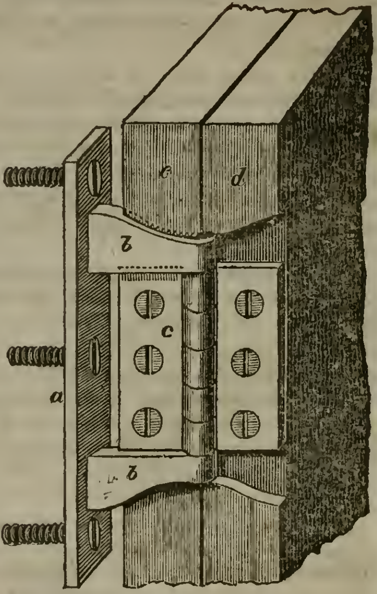
To let go the anchor, nothing more is requisite, than to let go the leading part of the catfall, which, by rendering, slowly transfers the weight of the anchor without surging to the stopper, which then unhooks the cat-block. By this plan, therefore, the anchor may be let go instantly, during any period of the act of catting it, and it may be let go, at any height between the cat-head and the water's edge. [*Ib.*

Method of Variegated Weaving, patented by Messrs. Gibbs *and* Dixon, *of London.* Enrolled July, 1826.

The object of the patentees, is the fabrication of cloths, (*piece goods*,) having a speckled appearance, and of variegated hues; this is effected by composing the weft or shoot, of two different coloured threads twisted together, which may be of silk, of silk and worsted, or of linen, cotton, silk, and worsted, variously combined. The more the colours are contrasted, the more brilliant, of course, is the effect: long specks or spots are produced by twisting the threads very slightly, and short, or minute ones, by a hard twist. The warp of the fabric, as well as the shoot, may be composed of a similar, or different, arrangement of threads, and thus, by slight variations, a great diversity of pretty patterns may be obtained. [*Ib.*

Improved Hinge for Library Doors.

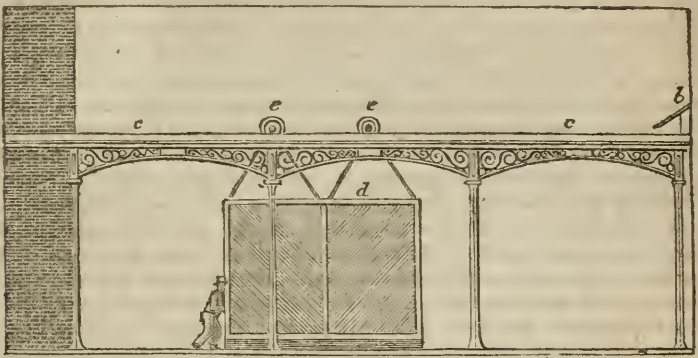
By the ordinary method of hanging doors to libraries, the hanging stiles are fixed to the vertical partitions of the shelves, and, being necessarily of a greater width than the latter, the books behind them cannot be got out without displacing those adjoining. To remedy this inconvenience, an exceedingly simple and effectual contrivance has been lately adopted.



a is a brass plate, which is screwed to an upright partition; *b b* are two projecting parts, (cast in one piece with *a*,) with the extremities rounded off, and perforated to receive the centre pin, which passes alike through them, and the joint of the common *butt-hinge c*. To the flaps of the latter are screwed the doors *d* and *e*, portions of which only are brought into view, to save room. It will be observed that the door *e* lays back quite level with the (supposed) shelves, and that the door *d* folds close against *e*, so as to lie parallel with it, and quite out of the way. This being the case as represented in the figure, it is equally obvious, that when the door *d* is turned back the contrary way, both doors are thereby shut, and lie quite flush and close; and that the door *e* may then in like manner be folded over *d*. The greatest facilities are thus afforded by a *single* hinge, instead of *two* hinges, and without the necessity of any additional hanging stile.—Upon the whole, we trust our readers will think with us, that this is a very clever little contrivance, and may be applied, with similar advantages, in many other situations besides library doors. [*Ib.*

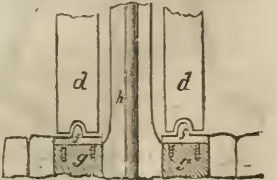
Description of the Suspension Gates, erected at the London Docks, by H. R. Palmer, *Engineer.*

Mr. H. R. Palmer, the inventor of the suspension rail-way, has recently erected at the London docks, some sliding, or rather rolling gates, which he has suspended in the way he proposes to suspend the carriages, in the former invention. In opening or shutting them, nothing need be moved out of the way, and it is done with great facility and despatch. Being suspended entirely from above, and not even touching the surface of the ground, they are not subjected to the adventitious obstacles common to other gates.



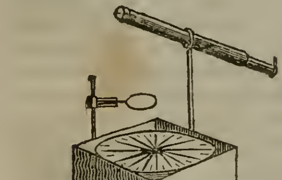
a is intended to represent part of the wall of the ranges of warehouses, and *b* the extremity of the range of sheds, on the opposite side of the avenue. *c c*, a double rail-way, extended entirely across the avenue from *a* to *b*, and likewise to the width of a gate beyond, on each side; it is supported by slightly curved arches of wrought iron, with ornamental scroll work between the arches and the double rail, the superstructure resting upon lofty columns of cast iron. One of the three gates *d*, (each of which fills up the space between two columns,) is shown in the act of being closed, by a man pushing it along: from its large dimensions and great weight, (though chiefly composed of wood,) this could not be easily effected by the simple force of one man; but being constructed on the principle of Mr. Palmer's patent rail-way, (a full description of which is given in the present number,) the friction is reduced to a very inconsiderable amount, the whole weight of each gate, being entirely suspended by iron rods, to the axles of the little wheels which run on the top of the rail-way, which are kept in their track by their peripheries being flanched.

The gates do not rest upon, or even touch, the ground, but are merely guided in their course, by means of a projecting edge fixed in their path: this will be easily explained by means of the annexed diagram, which represents a transverse section of these parts. *f f* are two plates of iron, with raised edges in the middle, which are screwed down to oaken sleepers *g g*; and above these, is shown an edge view of the lower ends of the gates, which run on either side of the column *h*. [*Ib.*



Description of a Fog Azimuth Compass, invented by Lieutenant GEORGE LINDESAY, R. N.

THE many losses of valuable ships, and lives, which have occurred to all nations, and which are still liable to occur, from the mariner being unable to ascertain his ship's exact situation at sea, in foggy and hazy weather, *when no horizon can be seen*, is a truth too well known to admit of dispute. Neither in the present system of navigation, nor among all the inventions and writings of the numerous authors on that subject, does there exist any effectual or unerring plan, for extricating a ship from this perilous predicament, which so frequently eventuates in the destruction of fleets, the interruption of commerce, and the loss of the lives of passengers, and of brave seamen. As the visibility of the horizon at sea, is necessary to the calculation of the sun's altitude, the danger of a ship being lost or misguided, in foggy and hazy weather of long continuance, when no horizon can be seen, may very easily be conceived. To arrive at the important desideratum now alluded to, some experiments have been suggested and attempted, but they have all proved inefficient. To obviate these difficulties and uncertainties, the present invention is offered to those interested in nautical affairs; the apparatus is very simple and convenient, and should it prove sufficiently accurate, it will be a very valuable acquisition to the science of navigation.



It consists merely of a telescope, attached to a common compass box, supported upon a tripod, and furnished with a magnifying glass, for reading off the divisions. This fog compass may also be occasionally used to give the place of the ship in clear weather, should the vessel be without sextant or quadrant, or those instruments out of repair.

Application.—In using this compass, it is recommended to take two bearings of the sun, as near to the meridian as possible, and to note the elapsed time by a chronometer or good watch, and then to proceed in the usual way, to calculate from these data the sun's meridian altitude, which will give the latitude, and the apparent time, which being compared with Greenwich time, will give the longitude.

ESSAYS ON LITHOGRAPHY.—No. VI.

Engraving on Stone, by indenting lines similar to engravings on copper. (en creux.)

For this species of engraving, which differs but little from that ordinarily effected upon copper, a perfectly polished and homogeneous stone is selected; upon this, nitric acid, diluted with water, is poured, which operation is sometimes repeated several times, according to the strength of the solution. It is important that it be spread with great regularity, over every part of the stone; and in order to effect this, the stone is held a little inclined, and the liquid poured from a glass having a large orifice. As a general rule for judging of the strength of the acid, a little of it may be applied on the end of the tongue, and if the sensation produced be about equal to that excited by very strong vinegar, it will answer the purpose. A drop of the mixture allowed to fall upon a lithographic stone, ought not to produce a strong and rapid effervescence, but the bubbles of air should be minute, and succeed each other slowly: a much more powerful acid, however, may be used in this species of engraving, than when ink, or crayons, are employed.

When the stone has been prepared by the aqua-fortis, it is to be washed with a sponge, and then rubbed over with gum water, containing about a fourth part of sugar-candy, or of honey, varying the proportion according to the humidity of the season. This coating of gum, which should be extremely thin, is suffered to become partially dry, and when it has assumed a sufficient consistency, lamp-black is to be rubbed over it, by means of a soft flat brush, about the width of three fingers; this must be carefully done, and with a light hand. The gum becomes impregnated with the black colour, forming a coating of equal thickness, and upon this the engraving is to be performed. If a coating of red is preferred, this may be produced by substituting finely ground red ochre, which may be incorporated with the gum water, adding a little sugar-candy, to render the coating less brittle, and to allow the point to enter with greater facility. The black ground will be found the most convenient, as it contrasts better with the white lines, which the artist produces in cutting the stone with the point. Sometimes the black colour is mixed up with the gum water, and spread upon the stone with a brush, or a sponge; but this manner of proceeding requires considerable address and experience.

When the ground with which the stone has been covered is sufficiently dry, and the design has been transferred to it, the engraving may be commenced; this is effected in the same manner as upon copper, observing, however, that the tracing upon stone should be less deep, for if the lines were cut down, as they are upon copper, the printing ink would not pass into them, or would not be taken off by the paper, in the operation of printing. Sharp and blunt points must be provided, of different sizes, in order to produce fine or broad lines, according to the nature of the work; for those which are broad, the point must be flattened at the end, and sharpened so as to terminate in right angles, in order to give to all the lines, an equal depth in every part. In tracing upon the stone, a white powder is produced, which must be removed by a soft brush, or a squirrel's tail, to enable the artist to judge correctly of his work. It must be recollected, that the traces will appear broader upon the stone, than they are in reality. By care, and practice, an engraving upon stone may be produced, which will be very nearly equal, in delicacy and fineness, to those which are executed upon copper.

In the art of engraving on stone, particular care must be taken to protect it from the action of the breath, from the mouth and nostrils; and also from the moisture of the hands. The former is effected by using a disk of tin, or of pasteboard, having a small piece of wood in its centre, which may be held in the mouth. A piece of thick paper, or of leather, will prevent injury from the hands. Should the stone become humid from any cause, the gum may spread itself, so as to pass into the lines which have been traced, and thus prevent the adherence of the printing ink.

When the engraving is completed, the lines are to be inked; to accomplish which, a pencil dipped in linseed oil, is lightly passed over them; this disposes them to receive the ink readily. The stone is suffered to remain in this state for two or three minutes, when the oil must be removed by covering it with blotting paper, and pressing upon it with the hand. After the removal of the oil, the traces are to be filled with printing ink, mixed up with a small portion of tallow; this operation should be performed quickly. The gum is to be removed by moistening the stone with water, and rubbing it with a sponge. When it is perfectly clean, the inking roller is to be passed over it; this must be charged with ink in larger quantity, and more fluid, than usual; impressions may now be taken in the ordinary way.

Instead of filling the traces with oil, in the manner prescribed, the following composition is sometimes used. Equal parts of tallow and of bees'-wax are taken, to these are added a small portion of oil, and of lamp-black, the whole of which are melted together, and well incorporated; the lines are filled with this composition by means of a sponge: the gum is then removed, and the impressions taken. This manner of proceeding is preferable to the former. If there are any faults in the engraving, these are to be repaired by lightly scraping the stone, preparing the part so scraped, covering it with a coating of gum, and engraving as in the first instance. Whenever impressions are taken from this species of engraving, the paper must be more freely wetted, and the pressure be more powerful, than is requisite in either of the other modes.

This method of engraving presents some advantages over that upon plates of copper; for, although the execution cannot be made equally fine, it excels in that softness which is so agreeable to the eye. The rapidity with which it is executed is very great, as it is only necessary to spread the gum, and to trace the lines; with a single stroke of a flat point, they are made of the desired widths, without the necessity of cutting, and recutting, a number of times. This mode is peculiarly adapted to geographical charts, and architectural designs. There has recently been invented, a machine which will trace lines exceedingly fine, and close to each other; and by its aid every species of design consisting of straight lines, may be executed, particularly back grounds, skies, and machinery in general. The art of engraving upon stone has been much neglected in France; yet this species is capable of furnishing very beautiful work, and that in a very economical manner. It is to be hoped that our artists will hereafter turn their attention to this interesting part of lithography.

It is not thought necessary to treat upon the process of engraving upon stone, by means of aqua-fortis, in the manner followed with copper. It does not appear to present any particular advantages, and besides, any person familiar with the other processes in lithography, would, after a few trials, readily succeed in this.

Imitation of Wood-cuts.

A perfect imitation of wood engraving may be produced lithographically. For this purpose a well polished stone is to be thinly, but evenly, covered with lithographic ink, observing that every part be rendered black by it. Upon this ground the design is to be transferred, or it may be sketched with a red crayon; when those parts which are to appear white upon a black ground, are to be removed by the aid of scrapers, points, and gravers, of different sizes. To produce the intended effect the stone need not be deeply cut; all that is necessary being the entire removal of the ink from those parts which are to appear white in the impressions. This proceeding is exactly the reverse of that followed in engraving by cutting lines on copper, or on stone. It is only where the drawing covers nearly the whole ground, with but a small proportion of white, or blank parts, that we work in this way: when the reverse is the fact, the design is transferred, or drawn with a pencil upon the bare stone; the lines are then covered with ink by means of a pen, or a pencil, as they are to appear when printed, those which are to appear white, remaining untouched. Those parts of the design which require light lines, may either be so drawn in the first instance, or a portion of the ink may be removed by means of the point, from the parts which are too strongly marked; this will always be determined by the nature of the work, which may sometimes be executed more easily, or more rapidly, by one than by the other of these methods. The portions of ink taken off by the point, or by the scraper, must be carefully removed with a hair pencil, for should they insinuate themselves between the black lines, or adhere to the naked stone, the impressions will be defaced by corresponding spots.

When the drawing is completed, the stone is to be prepared by a slightly acidulated water. This method allows, more readily than any other, of the rectification of any errors which may have been committed; it is only necessary to cover any defective part with lithographic ink, and to repair it in the way in which the work was at first performed. Etruscan vases upon a black ground are remarkably well represented in this way; the vases may afterwards be coloured by using a second stone. Arabesques, vignettes, visiting cards, and numerous other devices may also be produced by the same process.

There is another method of proceeding, which is by forming the lines of the drawing, with some deep transparent colour, mixed with gum water. Indian ink answers the purpose extremely well: those called body colours are apt to imbibe the oil which is rubbed upon the stone. When the drawing is quite dry, linseed oil is rubbed upon the stone, and is allowed to remain for seven or eight minutes, that it may be imbibed by those parts which are uncovered, and which is to form the ground. This oil is to be removed from the surface by rubbing it with a piece of soft linen; water is then poured upon the stone, in order to remove all the lines of the drawing, when it may be prepared by aqua-fortis, and impressions taken from it. This procedure leaves the lines white, upon a ground of black. The same kinds of work may be executed in this way, as by the former, and instead of black, the ground may be of any required colour.

ON JAPANNING AND VARNISHING.—No. 7.

On making colourless Lac Varnish by two different methods.

In our 4th volume, p. 130, we published Professor Hare's method of Bleaching Lac, so as to make a colourless varnish. We then stated that the Society, established in London, for the Encouragement of Arts, Manufactures, and Commerce, had continued to offer a premium of a gold medal, or thirty guineas, for the discovery of a process which should accomplish this object. Two applications for the premium have recently been made to the society; one of them by a gentleman of the name of Field, the other by a Mr. Luning. The processes of these gentlemen differ from each other; and it is stated in the account published by the society, that the method pursued by each of the applicants appearing to answer the intended purpose, it has been thought proper to give the reward for both of them.

Mr. Field's process for Bleaching Lac.

Six ounces of shell-lac, coarsely pounded, are to be dissolved by gentle heat in a pint of spirits of wine. To this is to be added a bleaching liquor, made by dissolving purified carbonate of potash in water, and then impregnating it with chlorine gas, till the silica precipitates, and the solution becomes slightly coloured.

Of the above bleaching liquor add one or two ounces to the spiritous solution of lac, and stir the whole well together; effervescence takes place, and when this ceases add more of the bleaching liquor, and thus proceed till the colour of the mixture has become pale. A second bleaching liquid is now to be added, made by diluting muriatic acid with thrice its bulk of water, and dropping into it pulverized red lead, till the last added portions do not become white. Of this acid bleaching liquor small quantities at a time are to be added to the half bleached lac solution, allowing the effervescence which takes place on each addition to cease before a fresh portion is poured in. This is to be continued till the lac, now white, separates from the liquor. The supernatant fluid is now to be poured away, and the lac is to be well washed in repeated waters, and, finally, wrung as dry as possible in a cloth.

The lac obtained in the foregoing process is to be dissolved in a pint of alcohol, more or less, according to the required strength of the varnish; and after standing for some time in a gentle heat, the clear liquor, which is the varnish, is to be poured off from the sediment.

"White lac varnish," says Mr. Field, "as above prepared, and used in a temperature of not less than sixty degrees, dries in a few minutes, and is not afterwards liable to chill or bloom; it is therefore applicable to drawings and prints which have been sized; and may be safely and advantageously used upon oil-paintings which have been painted a sufficient time, as it bears out colour with the purest effect. This quality prevents its obscuring gilding, and renders it a valuable leather varnish to the bookbinder, to whose use it has already been applied with happy effect, as it does not yield to the warmth of the hand, and resists damps, which subject bindings to mildew.

"As lac is the basis, even in name, of all the metallic lackers, colourless lac may afford silver and steel lackers, with little or no obscuration of their lustre. Its varnish polishes better than any other, and is applicable to some uses of the jeweller, to which purpose it has also been applied, as it has also, successfully, to the varnishing of light-coloured woods, and cabinet work, to which it is applicable in the manner of French polish; and there can be no doubt it would afford coloured lackers and varnishes of superior quality. In fine, the white lac varnish is generally applicable to the various purposes of other white hard spirit varnishes, and is to be used under the same conditions, and with the same management."

Various certificates, from persons who have used the varnish, follow the description of the process by which it is made. One manufacturer, it appears, had offered one hundred pounds for the process. The varnish is stated to be perfectly colourless, hard, and transparent; to dry rapidly, and to be perfectly free from tackiness, and from the vice of *blooming* (decomposing by moisture) so troublesome in white spirit varnishes in general.

Mr. Luning's process for Bleaching Lac.

Dissolve five ounces of shell-lac in a quart of rectified spirit of wine; boil for a few minutes with ten ounces of well burnt and recently-heated animal charcoal, when a small quantity of the solution should be drawn off, and filtered; if not colourless, a little more charcoal must be added. When all colour is removed, press the liquor through silk, as linen absorbs more varnish, and afterwards filter it through fine blotting-paper.

In cases where the wax contained in gum lac would be objectionable, filter cold; if the wax be not injurious, filter while hot.

On comparing Mr. Luning's varnish with Mr. Field's, in the state in which each was sent to the society, the former was of a much thinner consistence, and was rendered turbid, by scales of wax and a few particles of charcoal floating in it. On passing it through common white filtering paper, the impurities were separated, and the liquid came through in a more completely colourless state than Mr. Field's. This seeming advantage was, however, owing to the much greater state of dilution of Mr. Luning's varnish; for, when brought by evaporation to the consistence of Mr. Field's, they each appeared as nearly as possible of the same very pale yellowish tint; so that for the use of the painter and varnisher they may each be called equally colourless.

Mr. C. Varley having made some interesting comparative experiments on the two varnishes, his letter to the secretary, detailing the same, is here added.

March 31, 1827.

Sir,—I have varnished some of my sketches with Mr. Field's lac varnish, and some with Mr. Luning's ditto.

Mr. Field's varnish appears to me to answer all that can be expected from a varnish. It may be laid on as freely as any other varnish, and dries quick, brilliant and transparent. It is superior to all other varnishes in its approach to a glassy surface, and in freedom from tackiness. It is about a right strength or body, though I prefer a sample I had before from Mr. Field, which is as thick as can be laid on; for it is desirable for a varnish to be as thick as will allow time for it to be spread on, because it then thickens so soon, that its solvent has no time to act on the oil or colours of the picture.

Mr. Luning's varnish is a great deal too thin, and therefore requires two or three coats before it will bear out; and then, owing to its thinness, the activity of the spirit softens the first coat of varnish, and renders it uneven. It is not so brilliant as Mr. Field's, owing to the mixture (not solution) of wax, and is rather dirty, from the wax retaining some of the charcoal. Therefore I most decidedly give the preference to Mr. Field's varnish.

I have succeeded in throwing down both the wax and charcoal by adding spirit (essential oil) of turpentine, which dissolves the wax, and the solution then becomes sufficiently heavy to separate from the varnish; it requires at least one of spirit of turpentine to three of the varnish before the former is heavy enough to separate, and then it is scarcely a liquid, and separates very slowly; but if more spirit of turpentine is added, it goes down quicker. The varnish dissolves a small portion of the spirit of turpentine, which I feared might be an evil, when drying: but I cannot perceive that it makes any difference. Mr. Luning's varnish, when so freed, appears more colourless than Mr. Field's; but, if brought to the same strength, there would be very little difference; but probably a union of the two processes may produce the varnish like water, though the colour of each is at present equal or superior to most of the varnishes now in use, and will therefore stand at the head as the chief varnish.

I am, sir, &c.

A. AIKIN, Esq., *Sec.* CORNELIUS VARLEY.

In the Philosophical Transactions, vol. LXXXIV. is a chemical examination of lac by Mr. Hatchett, from which it appears, that one hundred parts of shell-lac consist of 90.9 resin, 4 wax, 2.8 gluten, and 0.5 extract. Cold alcohol will take up eighty-one parts of the resin, and leave the wax and gluten untouched; it would, therefore, probably, be an improvement on either of the above processes, to make the first solution of the shell-lac in cold, instead of in warm or boiling alcohol.

The first of the foregoing processes, it will be seen, bears a strong analogy to that of Professor Hare, which he invented some years since. The new process is objectionable on account of its requiring the lac to be twice dissolved in spirits of wine, which greatly enhances the cost of the varnish, the first portion of spirit being necessarily lost, as it would be a folly to attempt its recovery. We do not think that the subject is exhausted, but that the successful attempts to bleach this valuable resin, will lead to processes which will be more economical than either of those now before us, neither of which will be generally adopted.

Perhaps the lac might be bleached, by making a solution of it in potash, as practised by Dr. Hare, and then applying the animal charcoal, as used by Mr. Luning. The lac might then be precipitated by sulphuric, or some other acid, and afterwards dissolved in alcohol. Should this plan succeed, it will possess some advantages; we fear, however, that the animal charcoal will not be easily separated, nor will the process be simplified to the extent which we still hope it may attain.

Notice of MR. BULL's '*Defence of the Experiments to determine the comparative value of the principal varieties of Fuel, used in the United States,' &c.*—Philadelphia, Judah Dobson, Chesnut Street.

IN the first volume of this Journal, we published the "*Experiments to determine the comparative quantities of Heat evolved, in the combustion of the principal varieties of Wood and Coal, used in the United States, for fuel; and, also, to determine the comparative quantities of Heat lost by the ordinary apparatus, made use of for their combustion.—By* MARCUS BULL." This memoir had been read before the American Philosophical Society, and was immediately published in their transactions. It has since issued from the press in a separate form, and is therefore known to most scientific gentlemen.

In page 133 of our present volume, will be found an account of a premium founded by Count Rumford, to be given once every second year "to the author of the most important discovery, or useful improvements on heat, or on light, the preference always being given to such discoveries as shall tend most to promote the good of mankind." This trust was invested in the American Academy of Arts and Sciences, established in Boston. Although this premium was founded thirty years ago, its existence has not become generally known, even to persons engaged in the pursuit of the physical sciences: Mr. Bull, it appears, had been employed in the prosecution of his experiments, during six months, when he accidentally heard of it, and was advised to prefer his claim as a candidate for its bestowal. After completing the intended series of investigations, and publishing them, as directed by the Count, this application was made to the Academy, and referred to a committee. The work before us, is a pamphlet of about 50 pages, and contains an extended correspondence with this committee; their report, with remarks thereon, and animadversions on the manner in which the trust confided to the Academy, has been managed.

The objects proposed by Mr. Bull in undertaking his experiments, placed him, in the most direct manner, in the situation of a legitimate claimant, as this object was to "promote the good of mankind," by ascertaining the relative value of articles used as fuel, and which are perpetually called for by the necessities and habits of civilized man. The only question, therefore, to be determined, was, whether these experiments had been so performed as to accomplish their purpose; the committee, it appears, thought they had not, whilst Mr. Bull, and a number of his scientific friends, entertained a contrary opinion.

In order to attain the highest degree of accuracy of which the experiments were susceptible, Mr. Bull had a room of wood constructed within one of the chambers of his house; within this interior room his experiments on the heat evolved in combustion were performed, whilst the outer room was kept at a temperature of ten degrees below that of the interior, in which his essays were made; the intention of this arrangement was to obviate that uncertainty which would have resulted from any notable change of temperature, in the external atmosphere, during the progress of any experiment. The committee say, that although the atmosphere of the exterior room may be constantly kept at the uniform difference of 10 degrees below that of the interior, yet the *walls* of the two will not remain at the same difference at their opposite surfaces, as a reduction of temperature out of doors, will cool not only the outer, but also the inner surface of this wall, and thereby cause a greater radiation of heat to it, from the wall of the interior room, than when the atmosphere remained stationary from the beginning. As it was manifestly possible to ascertain any *appreciable* difference in the temperature of these two walls, Mr. Bull proposed to subject the validity of the objection to the test of experiment, contending that if this difference was inappreciable, the objection must be considered as invalid; and that although it might be theoretically true, the practical accuracy, and consequent utility of his results, would remain unimpeached. To the proposed test the committee demurred, and appeared to consider that their decision ought to turn upon the *theoretical* truth of their objection, as they do not limit it by 'the extent of an *example*,' but upon the truth of a *general principle.*

Mr. Bull subsequently ascertained, by a method which appears to us to be remarkably accurate, that when the difference of the temperature of the room, and that of the external air, was 30°, the difference of the heat of the surface of the wall within the room, and that of the air in contact with it, was so small as not to affect the most delicate instruments, ordinarily used for measuring differences of temperature.

It would seem to us, that the reasoning of the committee would inevitably lead to the conclusion, that it is impossible so to experiment upon the subject of Mr. Bull's inquiries, as to obtain any information which "shall tend to promote the good of mankind," and that we must ever remain in utter ignorance, of the relative value of the different kinds of fuel; as every experiment must, of necessity, be performed in places where there are radiating substances, and where radiation to a greater or lesser extent must be perpetually taking place. Indeed, the committee seem to have drawn this conclusion themselves, as in reply to a request that they would suggest what they would consider as satisfactory experiments, to determine the point in dispute, they observe, that they know of no experiments which can remove the difficulty.

A long continued series of experiments and observations made without the precautions observed by Mr. Bull, by employing in a common room, some of the ordinary apparatus for the combustion of fuel, might, from an average estimate of their results, furnish important practical information, although the accuracy of every individual trial should be far inferior to any one of those obtained by Mr. Bull. If this be admitted, it would require a complete inversion of all the ordinary modes of reasoning, to infer that experiments made with a minute attention to accuracy, by removing, as far as possible, every source of error, 'are of no practical value,' excepting they bear in every point, the rigorous test of a mathematical demonstration; a test which belongs not to the science of physics.

We have in the foregoing remarks, manifested our favourable opinion of the experiments of Mr. Bull, and with the exception of the committee of the Academy, we are not acquainted with a single man of science, whose impressions are not similar to our own. The experiments have been re-published in Europe, and have been viewed as models for future experimenters; if we err, therefore, we have the sanction of good company; and as the opinions expressed have not been formed, without a competent acquaintance with the principles involved, and a careful investigation of the subject, they must remain unchanged, until some better reasons are urged against them, than any which we have yet seen.

The concluding part of the defence, is devoted to an inquiry into the manner in which the academy has managed the trust committed to it, by Count Rumford. This premium, which was directed to be bestowed biennially, on "the author of the most important discovery, or useful improvement, which shall be made, and published by printing, or in any way made known to the public," has never been awarded, although, nearly thirty years have elapsed, since the time at which it should have been first given; it has in consequence accumulated, until, instead of a premium of 300, it now amounts to upwards of 2000 dollars biennially; a circumstance which tends to defeat the intentions of the donor, as it naturally and necessarily renders the academy averse to its bestowal in cases where the smaller sum would have been readily awarded. The following are the concluding remarks upon this point.

"It was the plain and evident intention of Count Rumford, that the premium should be awarded to the author of the *most important* discovery, or useful improvement, on the subject of *heat* or *light;* and there can be no doubt, that those subjects are susceptible of discoveries and improvements, of such a nature as was contemplated by the donor. Yet the Academy has never awarded the premium, and seems to act under the impression that no discovery or improvement of the kind can be made. What then is the plain duty of the Academy? If its opinion be, that the trust cannot be executed, that opinion ought to be announced in the most public manner; that the fund which is in the hands of the trustees, may go, where of right it belongs, to the representatives of Count Rumford. If no such opinion as this exists in the Academy, or if the opinion does exist, and is unsound, the Academy ought to execute the trust. To them is imparted, by the donor, the power of awarding the premium to the most important discovery or useful improvement; and consequently the power of judging; but this power is to be guided by a sound discretion, and to be exercised under a due sense and a just observance of the trust reposed in them. These then are questions, which the Academy is bound to answer, and to answer satisfactorily—how is it, and why is it, that this premium has never been awarded? how is it, and why is it, that this trust is not executed? how is it, and why is it, that scientific men are invited to direct their efforts, prosecute their researches, and exercise their faculties, on these subjects, under a delusive hope and promise of distinction and reward, which can never be attained?"

Mr. Bull owed it to his own reputation, to defend the well earned fame which his experiments had acquired for him, and we think that he has been eminently successful in the attempt; that he has made out a fair case, and shown that the objections urged by the committee, are of that hypothetical character, which a little ingenuity may raise in every similar case.

FOR THE FRANKLIN JOURNAL.

Observations on a Cement used in Spain, for the Preservation of Ships' Bottoms.

Charleston, S. C., March 10th, 1828.

Sir,—Although a distant subscriber, I have taken much interest in the success of your very valuable Journal, so well calculated to convey useful information among practical men, like myself. The observations by Mr. Gill, 'on various cements,' have brought to my recollection a circumstance which occurred some years ago, under my own observation; and I have thought that the publication of it might be of very material benefit to the marine department, and shipping interest of our country.

I am a practical shipwright, and have been constantly engaged in building and repairing vessels for twenty-eight years; in the year 1804, a large Spanish ship, which required considerable repair, arrived in this port, and was committed to my charge. On taking the old sheathing from the bottom, I found a coat of plaster, or chinam, which adhered so firmly, that it required considerable exertion to dub it off with the adze. It not only adhered to, but appeared to have become incorporated with the main bottom; its hardness was about equal to that of soft marble, or plaster of Paris, in its natural state. This cement had been on the ship's bottom for many years; and the captain, an elderly man, who was a native of Biscay, in Spain, requested that a similar covering should be again applied; on my expressing my ignorance of the nature of the preparation, he offered, with the assistance of the cook, to make the mixture for me, and desired that I would have two plasterers ready, with their trowels, to apply it, when the ship was in a state of readiness to receive it.

The composition he made as follows. The best barrelled stone-lime was taken, and slaked, by pouring on it just enough fresh water to produce that effect, and to cause it to fall into a dry white powder: this, when cooled, was sifted through a fine wire sieve, into a trough like a bread trough; there was then added to it, a portion of common fish oil, sufficient to bring it to the consistence of soft putty, so as to work with ease under the trowel. No water whatever was used, excepting that for slaking the lime in the first instance.

On the second day of sheathing, the plasterers had put on the width of two or three streaks, all fore and aft, more than we could cover, and this portion I concluded would wash off in the night, after we had righted the ship. The captain laughed at my fears, and said he would vouch for the cement being there in the morning, and to my no small surprise I found this to be the case. It had acquired a tinge of yellow, and was much harder than when put on, although it had been covered with the salt water during the whole night. The captain assured me that it would soon attain the hardness of that which had been removed.

The ship was one of about 450 tons, and, as nearly as I can recollect, the quantity of material used, was about five casks of the unslaked stone-lime, and I think, three sixty gallon casks of oil. I am not certain on this point, although I cannot err greatly; the consistence which the mixture must have, will be a sufficient guide for the proportions. In the process of making, and applying it, the information which I have given is perfectly correct. After it is prepared for use, it is kept in covered vessels to preserve it from the rain, or other moisture. The ship's bottom is prepared for sheathing in the usual way, by being paid with a coat of good half stuff, and allowed to cool, before the plaster is put on, as this accelerates its adhesion to the main bottom.

Although it is out of my province, and I am therefore unable, to form a judgment on this point, I have thought it worth inquiry whether this cheap cement might not be substituted for the costly Roman, or Dutch water cements. It would be worth the trial, whether it would not harden in fresh, as well as in salt water, and answer the purpose of building piers, locks, and other structures under water.

If you think these remarks likely to be useful, please to insert them, and oblige,

Yours, &c.

James Marsh.

On the cause of the Diurnal Fluctuations of the Barometer.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—Some years ago I communicated to the American Philosophical Society, a paper explanatory of the diurnal fluctuations of the Barometer. As that paper has not appeared in their transactions, and as no satisfactory explanation of this phenomenon has appeared elsewhere, although it has been attempted by Professor Leslie and others, I send you the substance of it now for publication.

The phenomena, as observed by many philosophers, in the East and West Indies, and in various parts of the torrid zone, are the following:—

From 6 to 10 in the morning, the barometer rises,
From 10 to 6 in the afternoon, it falls,
From 6 to 10 in the evening, it rises,
And from 10 to 6 in the morning, it falls.

Many years ago, Dr. Balfour instituted, at Calcutta, a most laborious course of observations on this subject, in which the height of the barometer was noted almost every half hour, for one lunation; and the preceding phenomena were observed, with but two or three slight exceptions. Humboldt observed nearly the same phenomena in the West Indies.

The cause of this fluctuation is so plain, that it is strange it did not occur to either of those philosophers. But it is still more strange that Mr. Leslie, who has done so much for meteorology, should have assigned so inadequate a cause as the sea breeze for this phenomenon.

Nor has Mr. Daniell been successful in his attempt to elucidate these fluctuations by his laborious theory of the polar winds.

The true cause of this phenomenon is the expansion, and, of course, rise of the atmosphere by heat, and the contraction and consequent fall of the atmosphere by cold. Suppose just before sun-rise in the torrid zone, the temperature of the air neither increasing nor diminishing, and of course the air neither expanding nor contracting, the barometer stands at 30 inches; now when the sun rises at 6 o'clock the air will begin to be heated near the surface of the earth, and of course, by its expanding, will elevate the superincumbent atmosphere; and this, by its inertia, will re-act on the air below, and thus press harder on the mercury of the barometer, than if it were at rest—and the more rapidly it is forced upwards, the greater will be its re-action downwards, and of course the more will the barometer be affected. It is manifest that the most rapid increase of heat and rarefaction of the air will take place somewhere between sun-rise and three o'clock, when the heat is the greatest, and this will evidently be near ten o'clock, at which time the barometer will stand highest. Though the heat is still increasing, and of course the air expanding, yet the rapidity of increase after this hour is not so great, and therefore the barometer will begin to fall, and at the moment of greatest heat, when the air is neither expanding nor contracting, the mercury will again stand 30 inches high. But now the air begins to contract from cold, and the mercury will therefore continue to descend, and the rapidity of the descent will be in proportion to the rapidity of the contraction from cold. Perhaps this effect may be more clearly understood by imagining an extreme case. Suppose the lower strata of atmosphere suddenly annihilated, the mercury of the barometer would be relieved from all pressure for a moment, and fall down into the basin; and if annihilation removes all pressure from the mercury, a contraction of the lower strata by cold will remove some pressure, therefore the mercury will fall—at the moment therefore of a most rapid decrease of heat, which is probably near sunset, the mercury will stand lowest, and will be below the height of 30 inches, at which I have supposed it to stand when the air is neither expanding nor contracting. The mercury will now begin to rise, for the rapidity of contraction diminishes from this moment, and the upper parts of the air are permitted more and more to press upon the lower with their whole weight, and even when the contraction ceases below, the upper parts having acquired a velocity downwards, are inclined to continue that motion, and thus by their momentum will press upon the lower parts with a force greater than their natural gravity, and thus the barometer will rise above 30 inches, at which height it was supposed to stand when the air was neither contracting nor expanding. This effect must take place sometime in the night, and it seems probable, a priori, that it would be about ten or twelve o'clock. Now, as the mercury at this hour stands higher than it does by the natural weight of the air at rest, it is plain that it will begin to fall as soon as the force of the superior parts of the air begins to spend itself on the inferior, and when all motion downwards has ceased, the mercury will again be pressed by the natural weight of the atmosphere, and so stand at 30 inches. In this situation the sun will rise upon it, and the same fluctuations will be renewed.

J. P. Espy, Prof. Lan.

Philadelphia, March 1*st*, 1827.

Postscript.—Since writing the above, I have seen the remarks of a very able writer in the American Quarterly Review, on Mr. Daniell's theory: as the reviewer seems to think Mr. Daniell's theory satisfactory, I will merely add that it is not true, that "the first effect of an increase of heat in the atmosphere will be to diminish its pressure," (see page 8 of last American Quarterly Review;) but, on the contrary, the first effect of heat will be to increase the pressure, and cause the air to move outwards and upwards, from where it is heated, and the current will not begin to run towards the heated part until the whole column of air, over this part, becomes lighter by some of the superior parts rolling off from their greater elevation.

On the construction of a Kite, for effecting a communication between a stranded Ship and the Shore, or under other circumstances, where badness of weather renders the ordinary means impracticable. By Captain Dansey.

A sail of light canvass or holland, is cut to the shape and adapted for the application of the principles of the common flying kite, and is launched from the vessel or other point, to windward of the space over which a communication is required, and as soon as it appears to be at a sufficient distance, a very simple and efficacious mechanical apparatus is used to destroy its poise, and cause its immediate descent; the kite remaining, however, still attached to the line, and moored by a small anchor, with which it is equipped.

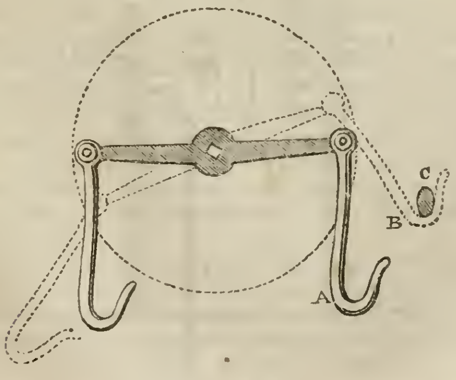
The kite, during its flight, is attached to the line by two cords, placed in the usual manner, which preserves its poise in the air; and to cause its descent, a messenger is employed, made of wood, with a small sail rigged to it. The line being passed through the cylindrical hole of this messenger, the wind takes it rapidly up to the kite, where, striking against a part of the apparatus, it releases the upper cord, and by that means, the head of the kite becomes reversed, and it descends with rapidity.

In the experiments made by Captain Dansey, with a view of gaining communication with a lee-shore, under the supposition of no assistance being there at hand, a grapnel, consisting of four spear-shaped iron spikes, was fixed to the head of the kite, so as to moor it in its fall; and in this emergency, the attempt of some person to get on shore along the line, would be the means resorted to. In those cases where a communication has been gained, and the maintainance of a correspondence has been the object, the person to windward has attached a weight to the messenger, in some cases as much as three pounds, which, having been carried up, has, of course, descended with the kite; the person to leeward has then furled the sail of the messenger, and loaded it with as much weight as the kite could lift, then replacing the apparatus, and exposing the surface of the kite to the direct action of the wind, it has rapidly risen, the messenger running down the line to windward during its ascent.

The kite with which Captain Dansey performed the greater part of his experiments, extended 1100 yards of line $\frac{5}{8}$ of an inch in circumference, and would have extended more, had it been at hand. It also extended 360 yards of line $1\frac{3}{4}$ inch in circumference, and weighing 60lbs. The holland weighed $3\frac{1}{2}$ lbs.; the spars, one of which was armed at the head with iron spikes, for the purpose of mooring it, $6\frac{3}{4}$ lbs., and the tail was five times its length, composed of 8 lbs. of rope and 14 lbs. of elm plank. A more particular description of Captain Dansey's apparatus, may be found in the 41st volume of the Transactions of the Society of Arts, (published in 1823) who presented him with their gold Vulcan medal, for his valuable invention, and communication.

Description of the Centrifugal Check-Hooks, to prevent accidents in raising articles from Mines, &c. Invented by EDWARD SPEER, Esq.

THIS contrivance forms part of an apparatus for preventing accidents in raising men and minerals up the shafts of mines. The numerous disasters which have happened in consequence of the *ropes running wild*, as it is called, has caused several plans to be devised for the security of those engaged in these works. Some of these have been too complex for general adoption, but against that here represented, this objection does not lie. Mr. Speer was rewarded by the Society of Arts, for this invention.



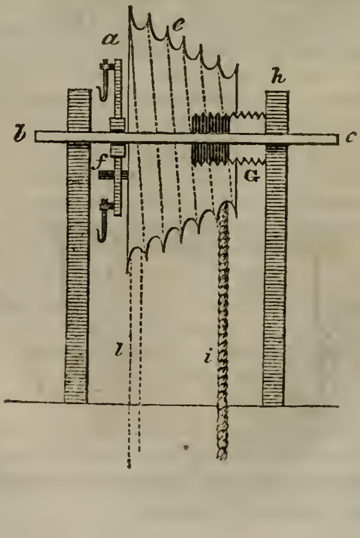
A bar is fixed on the end of an axis. Two hooks, as A, swing freely on the ends of this bar; C, is a short bar, or stop, projecting from the frame of the machine, on which the hook is intended to catch. When the bar revolves at a moderate rate, the hooks constantly hang down by their own weight, and do not touch the stop C; but when it revolves with a dangerous rapidity, the centrifugal force will cause the hooks to diverge from their pendant position, and one of these catches hold of the check-bar C, as shown by the dotted lines, and the machine is, of course, instantly stopped.

The editor of the Register of Arts remarks, that the instrument might be applied to cranes, and other machinery, and that it would be a decided improvement to give some degree of elasticity to the check-bar, to lessen the shock from sudden stopping. The succeeding communication resulted from the hint thus thrown out.

Improved mode of making the Centrifugal Check-Hooks, invented by Edward Speer.

TO THE EDITOR OF THE REGISTER OF ARTS.

SIR—You have inserted a description and engraving of Mr. Speer's centrifugal check-hooks, and have concluded the description with a remark, that some degree of elasticity should be given to the check-bar, in order to lessen the shock occasioned by the sudden stopping of the machinery. The subject of my present communication is a plan by which this defect would be obviated, and at the same time another decided advantage would be gained, which is, that when the velocity of the revolving wheel was so far reduced as completely to set danger aside, the machinery would not stop, but would recommence motion, always checking itself when it should have acquired a certain velocity.



In the above drawing, *a* is a section of Mr. Speer's check-hooks, (as described in the last article;) the bar to which the hooks are suspended, turns with the axle, *b c*. *e* is a conical pulley with grooves cut in a spiral direction, as represented in the section; this pulley turns on the axle, and not with it like the bar *a*. Out of this pulley at *f* proceeds the check-bar. G is a screw fixed to the frame *h*, which fits into the pulley *e*, so as to enter it as soon as the pulley is made to revolve in the same direction as the bar *a*. *i* is a cord fixed to the pulley *e*, so as to be wound round all the grooves when the pulley is turned; to the end of it is a fixed weight, the size of which must be regulated according to the velocity with which the machine is required to work.

Now it is evident from an inspection of the above plan, that when the check-hooks, by the too rapid revolution of the check-bar *a*, should have diverged so far from their natural position as to catch the check-bar *f*, the pulley *e* would be drawn round in the same direction as the bar *a*, and evidently would wind the weight suspended by the cord *i*, until the cord had reached the outermost groove as at *l*, when the machinery would be reduced to a proper velocity; at the same time the pulley *e* would be so far drawn back by the screw G entering it, as to have drawn the check-bar *f* out of the reach of the check-hooks, when the machinery would proceed in the regular way, and the cord *i*, by means of the weight attached to it, would, by turning round the pulley *f*, resume its original position, as shown at *i*, being always ready to regulate the machinery when the check-hooks should have so far diverged from their natural position as to catch the check-bar *f*.

Yours, &c.

W. LEAY.

A Steam Horse.

IN the London Journal of Arts, for February, Mr. Newton makes some remarks on the subject of steam coaches, and avers that, notwithstanding the people of that metropolis are constantly upon the look out for these vehicles, there is not at present in existence, nor in any tolerable state of progress, a steam coach likely to be applied to any public service; and that he shall continue so to declare, until one can be made to run *one stage of five miles, in the course of one hour, without stopping*; but that there does not appear to be any probability that Gurney's, or any other of these vaunted locomotive vehicles, will perform so very moderate a feat. The following are his concluding remarks.

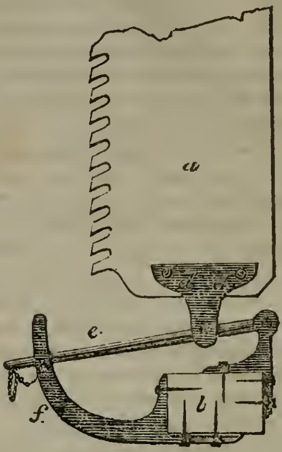
"Among our numerous correspondents upon this subject, one gentleman, well known in the inventive world, tells us that he perfectly agrees with us in opinion, that steam coaches are impracticable, but that he has something coming forward which will supersede their necessity; he is about to complete a STEAM HORSE."

A new and easy mode of fixing a frame Pit-Saw.

As a frame saw can be made thinner than a common pit-saw, it is in many instances important to employ it, to prevent that loss of timber, in valuable woods, which is produced by a thick kerf. The fixing and unfixing of a frame saw is, however, a frequent objection to its use; the subjoined plan has been devised to obviate this objection.

a, is the lower end of a frame saw; *b*, a section of the lower bar of the frame; *c*, the holdfast; *d d*, the two pins; *e*, the lever; *f*, a double arch piece with holes, the lever working between the two parts of the arch, the saw can be held to any degree of tightness, by a small peg fastened by a chain to the end of the lever.

To shift this saw, press the lever, take out the peg, lift up the lever, take out the pins *d d*, and the saw being lifted and swung back, can be put in the next cut, and fastened again.



AMERICAN PATENTS.

List of Patents granted in the United States, from November 15*th, to December* 31*st*, 1827.

FOR INVENTIONS AND IMPROVEMENTS.

In the making of ornamental hair combs, termed by the manufacturer, *side and neck combs;* Uriah Bailey, West Newbury, Essex County, Massachusetts, November 15.

In the hydrostatic steam cradle, for raising and transporting ships, or vessels, of any size or weight, over bars and shoals; Charles Miner, of Lyne, Conn., November 16.

In rolling the backs of tortoise shell combs; Nathaniel Bishop, of Danbury, Conn., November 17.

In an invention, or machine, by him called the frame chain; David Leslie, of New York, November 19.

In making leather water-proof; David Kizer, of New York, November 19.

In the mill for sawing timber, called the reciprocal saw mill; William Kindall, junr., of Waterville, Kennebeck County, Maine, November 23.

In the machine for washing clothes, and shelling corn; Benjamin Rice, of Denmark, Lewis County, New York, November 23.

In a machine for using the escape steam of an engine; Davis Embree, New Richmond, Clermont County, Ohio, December 3.

In the machine for turning rake and hoe handles; William Shepardson, and Josiah C. Sperry; the former of Hamilton, Madison County, and the latter of Camden, Oneida County, New York, December 3.

In the vest spring, and stiffener; James G. Shute, Boston, December 5.

In four wheel carriages; Theodore Brooks, and Daniel W. Eames, Rutland, Jefferson County, New York, December 6.

In the copper puncher; William Ballard, Boston, December 6.

In a machine called the windlass pegging jack; Samuel Nourse, Danvers, Essex County, Massachusetts, December 8.

In breaking flax; Henry Schoonhoven, town of Pulteney, Steuben County, New York, December 11.

In *hanging or slinging* the fore, main, and mizen yards of a vessel; Isaac Carver, junr., Prospect, Waldo County, Maine, December 11.

In the saw-mill; Benjamin Overman, Greenboro, North Carolina, December 11.

In the grist mill; James Robison, of Buckskin Township, Ross County, Ohio, December 11.

In warming and heating rooms; Archibald M'Allister, and John Iggett, of Salem, Washington County, New York, December 15.

In the common hand rake, for raking hay; Ambrose Foster, of Auburn, Cayuga County, New York, December 19.

In cutting fur; Machael Petre, of Womelsdorf, Berks County, Pennsylvania, December 20.

In the tread wheel; Cornelius Watson, of Addison Township, Galliopolis County, Ohio, December 22.

In propelling vessels; Elijah Bryan, of New York, December 22.

In distilling; James Lusk, of Butler County, Ohio, December 22.

In spectacles, and single eye-glasses; S. Newton, Washington, D. C., December 22.

In the Barshear plough; Eli Pugh, of Chatham County, North Carolina, December 24.

In the machine for turning rake handles; Anson Sperry, of Rotterdam, Schenectady County, New York, December 26.

In a machine called the sliding-plane turner; Jonathan Sparrow, of Portland, Maine, December 26.

In spinning cotton; John C. Dewees, of Mason County, Kentucky, December 28.

In the mortising machine; Abel Greenleaf, and Hollis Amidon, of the town of Mexico, Oswego County, New York, December 28.

In cast-iron sheeves for shipping; Frances Seymour, administratrix of Benjamin Seymour, of Plymouth, Massachusetts, December 29.

In the plough; Bird Murphy, of Union District, South Carolina, December 31.

In the saw mill; William Kindall, of Waterville, Maine, December 31.

ENGLISH PATENTS.

List of patents for New Inventions, which passed the Great Seal, in England, from November 22, to December 22, 1827.

To Robert Wheeler, brewer; for an improvement or improvements on, or in, refrigerators for cooling fluids—November 22.

To William John Dowding, clothier; for certain improvements in machinery for rollering wool from the carding engine—November 22.

To John Roberts, engineer, and George Upton, oil-merchant; for certain improvements on Argand and other lamps—November 24.

To John Alexander Fulton, spice merchant; for a process of preparing or bleaching pepper—November 26.

To Joseph Apsey, engineer; for an improvement in machinery to be used as a substitute for the crank—November 27.

To Joshua Jenour, jun., gentleman; for a cartridge, or case, and a method of more advantageously enclosing therein shot, or other missiles, for the purpose of loading fire-arms, and guns of different descriptions—November 28.

To Thomas Bonner, merchant; for certain improvements on safety lamps—December 4.

To William Fawcett, engineer, and Matthew Clark, engineer; for an improved apparatus for the better manufacture of sugar from the canes—December 4.

To Robert Walter Winfield, brass founder; for an improvement or improvements in tubes or rods, produced by a new method or methods of manufacturing them, and in manufacturing the same, (with various other improvements,) into parts of bedsteads and other articles—December 4.

To John Meaden, coach maker; for certain improvements on wheels for carriages—December 4.

To Samuel Wilkinson, mechanic; for improvements in mangles, which he intends to denominate Ballman's patent cabinet mangle—December 4.

To Maurice de Jough, cotton-spinner; for an improvement or improvements in machines, adapted for spinning, doubling, twisting, roving, or preparing cotton and other fibrous substances—December 4.

To Thomas Tyndall, gentleman; who, in consequence of a communication made to him by a foreigner residing abroad, is in possession of certain improvements in the manufacture of buttons, and in the machinery or apparatus for manufacturing the same—December 4.

To Daniel Ledsam, and William Jones, manufacturers; for certain improvements in machinery for cutting sprigs, brads, and nails—December 5.

To Joseph Robinson, brush-maker; for an improvement in the manufacture of brushes of certain descriptions, and in the manufacture of a material or materials, and the application thereof to the manufacture of brushes and other purposes—December 4.

To Paul Steenstrup, esq.; for certain improvements in machinery for propelling vessels; which improvements are also applicable to other purposes—December 11.

To John Harvey Sadler, mechanist; for certain improvements on power-looms, for the weaving of silk, cotton, linen, wool, flax, and hemp, and all mixtures thereof—December 13.

To Ralph Bewcastle, millwright; for a new and improved method of ballasting ships and other vessels—December 13.

To Robert Stein, gentleman; for an improvement in applying heat to the purpose of distillation—December 13.

To Frederick Benjamin Geithner, brass founder; for certain improvements on castors for furniture, and other useful purposes—December 13.

To Henry Peto, surveyor and builder; for an apparatus for generating power—December 13.

To Joseph Anthony Berrollas, watch manufacturer; for a method of winding up a pocket watch, or clock, without a key, which he calls Berrollas's keyless watch or clock; and also for a certain improvement, to be applied to his late invented detached alarum watch—December 13.

To Andrew Motz Skene, esq., a lieutenant in our royal navy; for an improvement or improvements in the mode of propelling vessels through the water, and for working under-shot water mills—December 15.

To John Lee Stevens, merchant; for a new or improved method or methods of propelling vessels through or on the water, by the aid of steam, or other means or power; and for its application to other purposes—December 18.

To Thomas Tyndall, gentleman; who, in consequence of a communication made to him by a foreigner residing abroad, is in possession of certain improvements in machinery to be employed in making nails, brads, and screws—December 18.

To John George, esq., barrister-at-law; for an invention for preserving decked ships or vessels, so as to render them less liable to dry rot; and for preserving goods on board such ships and vessels from damage by heat—December 18.

To Thomas Stanhope Holland, esq.; for certain combinations of machinery for generating and communicating power and motion, applicable to propelling or fixed machinery, as also floating bodies, carriages, and other locomotive machines—December 19.

To William Harland, M. D.; for improvements in propelling locomotive carriages, &c.—December 21.

To Charles A. Ferguson, mast maker, and James Atlee, gent.; for improved masts—December 22.

To William Hale, merchant; for an improvement in propelling vessels—December 22.

NOTICES.

NEW ARRANGEMENT IN PUBLISHING AND DISTRIBUTING THE FRANKLIN JOURNAL.

The publishing office of the Franklin Journal, will, hereafter, be at the Hall of the Institute. The Editorial department will remain unchanged, but the work has become the property of the Franklin Institute. Mr. William Hamilton has been appointed *Actuary*, and all communications relating to the subscription to, or the distribution of the Journal, should, hereafter, be addressed to him at his office. Communications for insertion, or relating to the objects of the work, may be sent either to the Editor, or to the Actuary.

The distribution of a widely extended periodical, requires the undivided attention of an individual; and it is believed that the new arrangement will insure a more prompt and efficient management in this particular, than has hitherto been found to be practicable, notwithstanding the care of the late agent. Although the principal publication office will be at the Institute, Mr. Dobson will continue to aid in the diffusion of the work, and will communicate to the Editor, or to the Actuary, whatever concerns its interests.

To Correspondents.—Mr. Bakewell's paper 'on loss of power,' Belidor 'on an improved steam valve,' and C, 'on the mode of communicating power from a water wheel,' require the aid of the engraver, but are intended to appear in our next number.

When drawings are sent, we should be obliged by their being made to such a scale, as will render their reduction unnecessary. We could then place them all at once in the hands of the engraver, and frequently avoid delay. This remark is intended for those who draw as well as our correspondent C. From those who are unskilled in the graphic art, we look for such delineations only, as shall aid us in understanding their purposes.

New Mode of Refining Sugar.—The Editor has received the remarks of a subscriber upon this subject. It had previously engaged his attention, and he has determined to publish, at large, Howard's process, which has been given by Mr. J. J. Hawkins, who was the engineer to whose management the establishment was committed. If the engravings can be completed, the first portion will be presented next month, otherwise it shall appear on the first of June.

We have some other communications which are under consideration; some which we have not found time to revise, and some which are incapable of revision. When plans of machinery are offered, which we think absurd, we do not deem it necessary to put the projectors to the expense of postage, for the objections which we might urge against their *discoveries:* were we to do so, the liberality of inventors might be put to a severe test, and we apprehend that our reward, in most instances, would be a charge of ignorance, for not being able to perceive what is so very clear to others.

THE

FRANKLIN JOURNAL,

AND

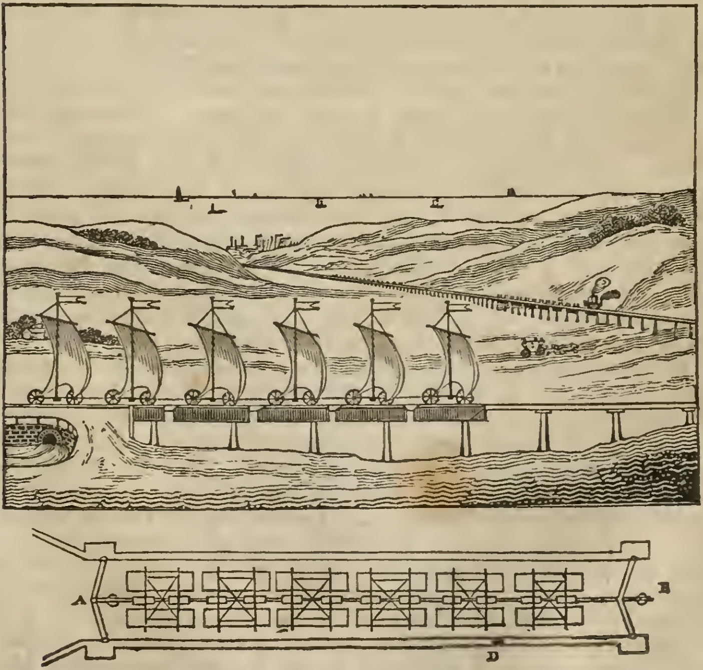
AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS,

Internal Improvements, and General Science.

MAY, 1828.

Proposed scheme of an Iron Rail-way, constructed on Palmer's *plan, in which the force of the Wind may be occasionally used as an auxiliary power.*



We are not among the number of those who consider the pages as wasted, which are employed in the publication of the whimsies of speculators in mechanics, even when we are convinced that they are incapable of being reduced to practice. Of this description are many of the schemes brought forward in some of those journals which are published in London, for the particular benefit of the operative classes. To detect error is to be in the highway to truth, both in moral and in natural philosophy; and we are confident, that some of the absurdities, which intelligent editors have admitted into their pages, have frequently, in the investigations which they have induced, advanced the cause of truth, much more than it would have been promoted by confining these works to those principles which are admitted as orthodox.

We seem, indeed, as far from having a standard of orthodoxy in mechanics, as we are on those subjects to which the term is most frequently restricted. Learned doctors in science, are not agreed with respect to what is the *true faith*, in the crank motion, in the maximum effect of falling water, and in upwards of *thirty-nine* other *articles;* and those who are less learned, must be allowed to dispute, upon minor points, and to acquire knowledge, in the same way in which it has been acquired by their seniors; that is, by the use of their understandings, in advancing from what is known, to that which is unknown. It is only when those who assume the character of grave philosophers, advance principles which contradict the truths which have been established by accurate experiment or legitimate deduction, that we are inclined to animadvert with severity. Every editor has often felt that it was no easy matter to discover the exact point at which he ought to close his pages. When what we are convinced is erroneous, is supported with great ingenuity and talent, a writer has a just claim upon the conductors of the public press, and they must be excused from assuming the invidious station of umpires, or even from feeling themselves compelled, in all cases, to avow their dissent, from the doctrines advanced. We make these remarks, with a view to their application to what we borrow from other journals, as well as to some things which we present as original communications. When, and to what particular articles they are to be applied, must be left to the judgment of others.

In our last number, we published the description of an improved iron rail-way, by H. R. Palmer: the engraving at the head of this article presents a proposed application of the single rail in the conveyance of fish, from Brighton, or elsewhere, to the London market, as well as for carrying goods and passengers. The writer also believes that the power of the wind, as well as that of horses, or of steam, may frequently be employed in carrying his scheme into effect. The propositions are brought forward as a new project, in a tone and manner which suit the subject, and, therefore, do credit to the writer. The landscape is not intended to represent any particular spot, but merely to illustrate the thoughts of the author; it is intended to represent a rail-way, leading to a sea-port, with the carriages being propelled according to the modes projected by Mr. Palmer. The train of carriages in the distance, is supposed to be drawn by a horse, the next by a steam engine, and that in the fore ground is represented as furnished with sails.

"Sailing over land," observes the writer, "is not a new idea, nor is it new in practice. For more than a hundred years, in some parts of Holland, four-wheeled carriages have been propelled by the wind over the common ground, on level plains. If the Hollanders, have found it practicable, or advantageous, to sail in this clumsy unimproved way, how much more practicable and advantageous would it be to bring into use the admirable means furnished us by Mr. Palmer, in his new rail-way, in which the friction, or resistance to the motion of the carriages, is reduced to one-twentieth part; or rather, wherein the facilities are increased in the reverse proportion? If in Holland, as is stated, they could sail, after their manner, twenty miles in an hour, with a good wind—with what an astonishing velocity might not the vessels, or carriages, sail on the proposed rail-way, when impelled by an equal power! As objections will, no doubt, be raised on account of the variableness of the wind, I must repeat, that I only propose it as an *auxiliary* power. It would rarely happen that the wind was not favourable in going, or returning, as a side wind would answer the purpose. I would propose in the absence of a steam engine, (which every proprietor of a train of carriages might not be able to afford,) that a horse should always be in attendance; so that when employed in drawing a train along the rail, if a breeze of wind should spring up, the sails might be spread; and the horse clapped into a carriage properly constructed to accommodate his noble person, where, in comfort, feasting over his bag of corn, his frame would be re-invigorated for fresh exertion, should the wind happen to fail.

"Having now given the outline of my first project, and being fearful of wearying the patience of your readers, I proceed to my second, which will explain the meaning of the sailing vessels in the fore-ground of the drawing, that are apparently issuing out of a canal lock. My intention in this was, to exhibit an easy, and obviously practicable mode, of transferring heavily laden vessels directly out of the water on to the rail-way, where they might be propelled by the wind with as much velocity as through the water; and at the same time to show how admirably Mr. Palmer's rail-way is adapted as a branch communication to, and from, canals and rivers, or to form an important connecting line between them.

"In cutting a canal, which has to proceed down a declivity, and to ascend another inclined plane, numerous locks must be constructed at an enormous expense, which cause great loss of time, and inconvenience in the traffic. This heavy expense and inconvenience would be completely obviated by the adoption of Mr. Palmer's railway—as a connecting communication.

"The vessels issuing from the lock, are supposed to have entered it from some river, or canal, (as at A in the ground plan of a lock.) The rail-way is constructed as usual, elevated upon pillars—and does not terminate on arrival at the lock gates, but passes over them, and terminates at the other end of the lock, just within the second gates, and is supported on pillars from the bottom of the lock, the same as on dry ground. The double train of vessels having all entered the lock, half on one side the rail, and half on the other, they are hooked on to the axletrees of the wheels which are already upon the rail, prepared for that purpose. The gates next to the river, or canal, are then closed, and all being fast, the water is let out of the lock by a sluice, (shown in the drawing,) till it falls below the bottom of the outer gates, at which time the vessels are all suspended on their axles, in the air—the gates are opened, and they sail out across the valley;—or they are propelled by whatever other power may be eligible.

" *Description of the Plan of the Lock.*

" A is the end of a canal or cut from a river, with the lock gates adjoining. B is the exterior of the other end of the lock, over the whole length of which the rail-way extends; a portion of which is seen at B. On the rail-way are shown the edge view of the wheels, with the axletrees, which extend over the vessel, two to each vessel; the vessels are thus arranged, and hooked on to the axletrees, when the sluice D is opened, and the water let out, which leaves the vessels suspended."

Observations on Coppering Ships, and a description of the Method of Fastening a Ship's Side with the Iron Knees, invented by E. Carey, *Inspecting Shipwright, and Surveyor of Shipping.*

On observing one of my ships, after being coppered on the blocks in a dry dock, when floated out, I found that her copper under the buttocks, for a considerable way forward, and on the luff of the bows, for a great way aft, had become a great deal wrinkled or puckered; as this appeared very unsightly, and as I knew that the raised parts of the copper, from meeting with resistance, would soon be worn through, I gave the ship a careen, took the copper carefully off, had it beaten smooth, and put on again. The consequence was, that the copper remained smooth until I new coppered the same ship again.

I find that all ships drop forward and aft, more or less, according to their strength, when first launched off the stocks, or floated from a straight block, in a dry dock. I therefore now determined to sheath my ship up no higher than light water-mark, while in dock, on straight blocks, and, in two or three days after the ship had settled, to finish the coppering. I did so, and had the satisfaction to see my copper continue smooth to the last. This information may be worthy the notice of merchants and ship-owners.

Method of Fastening a Ship's Side with the newly-invented Iron Knees.

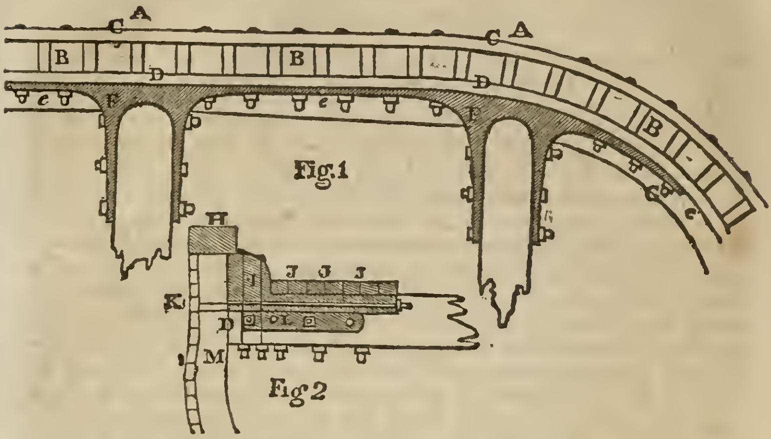


Fig. 1 is a horizontal section of a portion of a ship's side and beams.

A A shows the ship's side—B B B the timbers—C C the thickness of the outside planking—D D a plank, 3½ inches thick, which goes all round the ship, inside the timbers, against which the iron knees are fixed, and bolted through the side—*e e e* a horizontal clamp, 10 inches wide, and 6 inches thick—F F the iron knees, 4 inches wide, and 2 inches thick, which are bolted through the beams and ship's side, as at G G.

Fig. 2 is a vertical section of the same parts as fig. 1.

H is the plank-sheer—I the water-way—J J J the ends of the planks—K a bolt that goes through the ship's side, through the edge of the water-way, and six streaks of the deck, below the beam, and is clenched on an iron plate on the inner plank—L arm of the knee—M the ship's timber and side—D is an edge view of the inner plank, as shown at D, fig. 1.

The above is a rough sketch of my new-invented Iron Knee and water-ways, which are let down upon the beam 3 inches, and also six of the deck planks, and bolted through all; under the beam a plank 3½ inches thick is first brought on, inside the ship, against which the ends of the beam are fixed. The horizontal clamp, 10 inches wide and 6 thick, is then brought on under the edge of the plank, and bolted through the side. On this clamp the beam is dovetailed in one inch down, and bolted through the end of the beam. A ship fastened in this way will render it impossible for the side to move; consequently no wet can possibly get down, and the ship must be kept perfectly dry and sound.

E. Carey.

[*Register of Arts.*

OF CLOCK AND WATCH-MAKING, AND OF THE METHOD OF DIVIDING THE DAY AT DIFFERENT PERIODS OF TIME.

[Continued from p. 248.]

Further progress of the theoretico-practical part of Clock and Watch-making till the end of the 18th century.

HUYGHENS, it has already been said, applied the pendulum to clocks, in the year 1657, but it was soon found that a pendulum vibrating in the arc of a circle, varied in the time of its vibration, as the arc decreased or increased. To obviate this, Huyghens invented the cycloidal plate; and De la Hire assures us, that this cycloidal pendulum clock, though often compared with the motion of the fixed stars, did not differ in eight days but a few seconds from the mean motion of the sun. But Huyghens himself soon found that the plate could not be made in a cycloidal form, and that the silken threads by which the pendulum was suspended did not answer the purpose, but that a pliable spring could be used in their stead. He then invented, for the purpose of more perfect regulation, that singular pendulum called *pirouette*, which has a cruciform motion. This, however, was also rejected. About the end of the 17th century, Derham and Hook conceived the idea of making the pendulum swing in small arches, and applying heavy lenticular weights. This method was adopted by Le Bon and De Rivaz at Paris, and by Clement in London, who also invented the, so called, English pallet.

Another difficulty to be overcome in regard to clocks and watches, was the influence which heat and cold have upon the expansion and contraction of metals, and which alters the motion of the whole. Graham is considered as the first who made experiments with a view of freeing the pendulum from such changes. He first conceived the idea of making pendulums of ebony, fir-wood, walnut-tree, &c.; but found that the moisture of the air produced other inconveniences. Experiments of the same kind were afterwards made by Magellan, Fontana, Ludlam, Schröter, Crostwaite, and Köhler. Graham next constructed a pendulum of an iron tube, which was filled to a certain height with quicksilver. Troughton, instead of an iron tube filled with quicksilver, employed one of glass, having at the end a bulb like the tube of a thermometer. But still happier was Graham's idea, to construct a pendulum of several rods of different metals, so combined, that the expansion of the one should be fully compensated by the contraction of the other; and this gave rise to the gridiron pendulum. Before Graham, however, Short, Cassini, and Ellicot had entertained a similar idea of a compound pendulum; and the plan of a gridiron pendulum was first carried into execution by Harrison in the year 1726. Besides the pendulum proposed by Graham and by Harrison, several other modifications of the same principle were applied by different persons, as by Berthoud, Grenier and Syffert. A lever pendulum was invented by Ellicot, and another by Grenier: the tubular pendulum was contrived by Rivaz, and the most simple of all, the compensation pendulum, by Faggot, a Swede, about 1740, and which Schmidt, a watchmaker of Stettin, has lately employed with much ingenuity.

The highest degree of perfection, however, to which watch-making has attained, is in the construction of the nautical time-keepers, for the invention of which large premiums were offered in England, France, Holland, and Spain. Huyghens and Sulley made attempts for this purpose, but they were not attended with success; and the ingenious proposals of Leibnitz were not found sufficient. Harrison's first time-keeper, which he presented to the Royal Society in 1736, was regulated by balancing rods, placed crosswise over each other, with circular springs at the ends, which rested against two plates, which by the dilatation of the circular springs, in consequence of heat, separated, and on their contraction, by cold, approached each other. The friction also was lessened, and the time-keeper was suspended like the mariner's compass. In a voyage of twelve weeks, the error in going amounted only to 36 seconds. A second one, constructed in 1749, which was smaller and more convenient, surpassed the first. To a third, constructed in 1753, he applied a balance with a spiral spring, and a compensation rod of brass and steel. In 1761 he constructed a fourth, which, on a voyage of experiment that lasted 81 days, erred only 1 minute 54½ seconds. A fifth, finished in 1764, erred only 54 seconds in six weeks. Dr. Maskelyne, however, to whom it was afterwards referred for trial, did not give so favourable a report of it. Berthoud and Le Roy made attempts also to construct time-keepers; but the first were not successful. In the year 1741 Le Roy's time-keeper, which in six weeks erred only half a degree, was preferred to that of Berthoud, which in the same time erred 34 minutes 36 seconds. The time-keepers of Arnold, Rendai, and Mudge, were found to be exceedingly correct. Mudge constructed only three; the first of which was tried, in the year 1774, by Dr. Maskelyne, Hornsby, Count Bruhl, Von Zach, and Campbel. The other two were tried by Dr. Maskelyne in 1777. One of them, in the course of 93 days, was found to have exceeded the mean time by only 1 minute 1·8 second. It showed the longitude between London and Oxford within 1·6 second. The balance vibrated altogether independently of the wheel-work, and always received from the moving power a new impulse, which at each vibration was uniform. The balance had two spiral springs, which produced a very uniform action. Besides this, the machine was furnished with a compensation balance. In imitation of the nautical time-keepers, pocket chronometers were constructed. These serve for determining the geographical longitude on land. In these the free scapement of Mudge is employed. Emery, an artist from Neufchatel, made the first, which, after a passage of four weeks, gave the longitude of St. John's, Newfoundland, correct within six seconds. Another, constructed by Mudge, in a voyage of 14 weeks, erred only 17 seconds. Mudge never made but two pocket chronometers. Arnold made above 900, of various constructions. His chronometers of the best kind, with gold cases, cost 120 guineas, with silver cases, 100.

ACTIVE AND PASSIVE STRENGTH.

*Sec. II.—Passive Strength.**

[From Gregory's Mathematics for Practical Men.]

[CONCLUDED FROM P. 234.]

The modulus of the elasticity of hempen fibres has not been ascertained. Their cohesion is, for every square inch of transverse section, 6,400 lb. The best mode of estimating the strength of a rope of hemp, is to multiply by 200 the square of its number of inches in girth, and the product will express in pounds, the practical strain it may be safely loaded with; for cables, multiply by 120, instead of 200. The ultimate strain is probably double this; as will appear from the following account of Du Hamel's experiments. If yarns of 180 yards long, be worked up into a rope of only 120 yards, it will lose one-fourth of its strength, the exterior fibres alone resisting the greatest part of the strain. The register cordage of the late Captain Huddart, exerts nearly the whole force of the strands, since they suffer a contraction of only the eighth part in the process of combining.

For the *utmost* strength that a rope will bear before it breaks, a good estimate will be found by taking *one-fifth of the square of the girth of the rope*, to express the tons it will carry. This is about double the rule for practice which we have just given, (art. 32;) and is, even, for an ulterior measure, too great for tarred cordage, which is always weaker than white.

The following experiments were made by Mons. Du Hamel, at Rochfort, August 8th, 1741, on cordage of 3 French inches circumference, made of the best Riga hemp.

	White.	Tarred.
Broke with strain of	4500 pounds	3400 pounds.
	4000	3300
	4800	3258
	August 25th, 1743.	
	4600	3500
	5000	3400
	5000	3400
	September 23d, 1746.	
	3880	3000
	4000	2700
	4200	2800

A parcel of white and tarred cordage was taken out of a quantity which had been made February 12, 1746.

It was laid up in the magazine, and comparisons were made from time to time, as—

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* We have omitted a considerable portion of this section, as being much too abstruse for mechanics in general. The omitted portion relates principally to the strength of timber, a subject of vast importance, and to which we shall revert, after moulding it into a popular form.

	White bore.	Tarred.	Difference.
1746 April 14th	2645	2312	333
1747 May 18th	2762	2155	607
1747 October 21st	2710	2050	660
1748 June 19th	2575	1752	823
1748 October 2nd	2425	1837	588
1749 Sept. 25th	2917	1865	1052

M. Du Hamel says, that it is decided by experience, that white cordage, in continued service, is one-third more durable than tarred; secondly, it retains its force much longer while kept in store; thirdly, it resists the ordinary injuries of the weather one-fourth longer. These observations deserve the attention of practical men.

The metals differ more widely from each other in their elastic force and cohesive strength, than the several species of wood or vegetable fibres. Thus, the cohesion of fine steel is about 135,000 lb., for the square inch, while that of cast lead amounts only to about the hundred and thirtieth part, or 1800 lb.

According to the accurate experiments of Mr. George Rennie in 1817, the cohesive power of a rod, an inch square, of different metals, in pounds avoirdupois, with the corresponding length in feet, is as follows:

Cast Steel,	134,256 lb.	39,455 feet.
Swedish Malleable Iron,	72,064 lb.	19,740 feet.
English ditto,	55,872 lb.	16,938 feet.
Cast-Iron,	19,096 lb.	6,110 feet.
Cast Copper,	19,072 lb.	5,003 feet.
Yellow Brass,	17,958 lb.	5,180 feet.
Cast Tin,	4,736 lb.	1,496 feet.
Cast Lead,	1,824 lb.	348 feet.

It thus appears, as Professor Leslie remarks, that a vertical rod of lead 348 feet long, would be rent asunder by its own weight. The best steel has nearly twice the strength of English soft iron, and this again is about three times stronger than cast-iron. Copper and brass have almost the same cohesion as cast-iron. This tenacity is sometimes considerably augmented by hammering or wire-drawing, that of copper being thus nearly doubled, and that of lead according to Eytelwein, more than quadrupled. The consolidation is produced chiefly at the surface, and hence a slight notch with a file will materially weaken a hard metallic rod. English malleable iron has 7,550,000 feet for its modulus of elasticity, or the weight of 24,920,000 lb. on the square inch, while cast-iron has 5,895,000 feet and 18,421,000 lb. Of other metals, the modulus of elasticity is probably smaller, but has not yet been well ascertained.

The *longitudinal compression* which any column suffers, is at first equal to the dilatation occasioned by an equal and opposite strain, being in both cases proportional to the modulus of elasticity. But while the incumbent weight is increased, the power of resistance likewise augments, as long as the column withstands flexure. After it begins to bend, a lateral disruption soon takes place. A slender vertical prism, is hence capable of supporting less pressure than the tension which it can bear. Thus, a cubic inch of English oak was crushed only by the load of 3860 lb., but a bar of an inch square and 5 inches high gave way under the weight of 2572 lb. It would evidently have been still feebler if it had been longer. On the other hand, if the breadth of a column be considerable, in proportion to its height, it will sustain a greater pressure than its cohesive power. Thus, though the cohesion of a rod of cast-iron of the quarter of an inch square, is only 300 lb., a cube of that dimension will require 1440 lb. to crush it.

In general, while the resisting mass preserves its erect form, the several sections are compressed and extended by additional weight, and their repellent particles are not only brought nearer, but multiplied. This repulsion is likewise increased by the lateral action arising from the confined ring of detrusion. The primary resistance becomes hence, greatly augmented in the progress of loading the pillar.

The most precise experiments on this subject seem to be those of Mr. Rennie. The weights required to crush cubes of the quarter of an inch of certain metals, are as follow:

Iron cast vertically,	11,140 lb.
Iron cast horizontally,	10,110 lb.
Cast Copper,	7,318 lb.
Cast Tin,	966 lb.
Cast Lead,	483 lb.

Cubes of an inch are crushed by the weights annexed:

Elm,	1,284 lb.
White Deal,	1,928 lb.
English Oak,	3,860 lb.
Craigleith freestone,	8,688 lb.

Cubes of an inch and a half, and consequently presenting a section of $2\frac{1}{4}$ times greater than the former, might be expected to resist compression in that ratio. They are crushed, however, with loads considerably less.

Red brick,	1,817 lb.
Yellow baked brick,	2,254 lb.
Fire brick,	3,864 lb.
Craigleith stone, direction of the strata,	15,560 lb.
Ditto, across the strata,	12,346 lb.
White Statuary Marble,	13,632 lb.
White-veined Italian Marble,	21,783 lb.
Purbeck Limestone,	20,610 lb.
Cornish Granite,	14,302 lb.
Peterhead Granite,	18,636 lb.
Aberdeen Blue Granite,	24,536 lb.

These facts show the comparative firmness of different materials, but it is to be regretted, that such results are not of much practical value, since they are confined to a very narrow scale, and applicable only to cubical blocks. While the breadth remains the same, the resistance appears to depend on some unascertained ratio of the altitude of the column.

Nay, as Professor Leslie observes, the absolute height itself has' probably, a material influence on the effect. Thus, from some experiments made in France, it appears, that prisms of seasoned oak, two inches square, and two, four, or six feet high, would be crushed by the vertical pressures of 17,500 lb., 10,500 lb., and 7,000 lb.; but, if four inches square, and of the same altitudes, they would give way under loads of only 80,000 lb., 70,000 lb., and 50,000 lb. In the first set of trials, the mean cohesive power amounts to 130,000 lb., and in the second, to 520,000 lb. The vertical support is, therefore, greatly inferior to these limits. When the length of the pillar exceeds 36 times its breadth, the resistance to longitudinal compression appears to be diminished 18 times.—[*Leslie's Elements*, and *Duhamel in Mem. Paris. Acad.*

Mr. B. Bevan has favoured the author with a tabular view of his results with regard to the *modulus of cohesion*, or the length in feet of any prismatic substance required to break its cohesion, or tear it asunder.

Bevan's Results.

	Feet.
Tanned cow's skin,	10,250
——— calf skin,	5,050
——— horse skin,	7,000
——— cordovan,	3,720
——— sheep skin,	5,600
Untanned horse skin,	8,900
Old harness of 30 years,	5,000
Hempen twine,	75,000
Catgut, some years old,	23,000
Garden matting,	27,000
Writing-paper, foolscap,	8,000
Brown wrapping-paper, thin,	6,700
Bent grass, (holcus,)	79,000
Whalebone,	14,000
Bricks, (Fenny Stratford,)	970
——— (Leighton,)	144
Ice,	300
Leicestershire slate,	7,300

On Blowing Air into Furnaces by a Fall of Water. By the late WILLIAM LEWIS, M. D.

[Continued from p. 241.]

EXPERIMENTS AND OBSERVATIONS FOR THE IMPROVEMENT OF THE FOREGOING MACHINES, AND FOR ESTABLISHING THEIR PRINCIPLES OF ACTION.

I. *Of the quantity of water they require, and the quantity or force of the air they afford.*—The quantity of water may be estimated with sufficient exactness from the height of the water in the funnel or basin at the top, and from the width of the choak or throat of the funnel, through which it is pressed by the force of a column of that height.

Desaguliers found, by an experiment often repeated, that the quantity of water running through a square inch hole, twenty-five inches under the surface, is five tons and a fifth in an hour, the ton containing two hundred and fifty-two gallons. The quantities discharged through equal holes at different depths, being as the square roots of the depths, and the quantities through different holes, at equal depths, being as the areas of the holes, it will appear, on calculation, that in the machine at Lead-hills, whose funnel is five feet high, and its throat three inches and a half in diameter, the expense of water is somewhat more than seventy-seven tons in an hour, or near three hundred and twenty-four gallons in a minute; and that in the machine of Dauphiny, where the height of water in the funnel is only about half as great, and the bore of the throat a little wider, the quantity of water is about two hundred and sixty-six gallons in a minute. Perhaps the real quantity of water may be somewhat less than this calculation given, as the resistance of the compressed air may occasion some retardation of the motion. Of the other machines, the descriptions are too imperfect or obscure for any computation to be made from them.

The water issuing from the narrow throat of the funnel with great velocity, is said to spread so as to fill the wider bore of the pipe, and to become frothy, from the mixture of air with it. The jet, thus enlarged, may be conceived as consisting of a multitude of slender streams or drops, the intervals between them being occupied by air, which is continually supplied through the air-holes, and pushed down by the succeeding drops or streams. It has therefore been reckoned, that the volume of air which passes down the pipe, must be as much greater than that of the water, as the transverse area of the jet, when spread and reduced to drops in the pipe, is greater than when it passed through the throat of the funnel. Circles being to one another as the squares of their diameters, the area of the pipe of the Lead-hills' machine will be to that of the funnel's throat, as eighteen to twelve and a quarter: the volume of air, according to the above principle, being to that of the water in the same proportion, and the quantity of water nearly 324 gallons in a minute; the quantity of air in a minute should be about 475 gallons and a half, or 134,000 cubic inches, or 176 cubic feet of air in a minute: so that, by this way of reckoning, the Dauphiny machine, with nearly a fourth less water than that of Lead-hills, should produce more than a double quantity of air.

But though this method of computation appears specious, it is not, perhaps, to be much depended on; air, in different circumstances, occupying very different volumes, in virtue of its great compressibility; nor is it certain that the bores of pipes are sufficiently filled, so as to carry down the full quantity of air. It may be presumed that the air, intermingled in the jet, is always in some degree compressed by the water, so that the interstices between the streams or drops contain more air than equal spaces of the atmosphere. It may be judged, however, from the above comparison, that the wider the pipe is, in proportion to the funnel's throat, provided the water running through the throat will spread through the whole extent of the bore of the pipe, the more air will be carried down.

M. Barthès, the only person I know of who has examined these machines philosophically, and endeavoured to improve them, gives a method, in the memoir above quoted, of comparing the proportional quantities or forces of the air, in different blowing machines, on another principle. From considerations, too abstracted to be here particularized, he deduces a general rule, that the produce of air will be, in all cases, in proportion to the quantity and velocity of the water: so that the quantity of water and height of the fall being given in two machines, and the volume or force of the air in one of them being measured by experiment, the volume or force of air in the other may be determined by the rule. Accordingly, he made several experiments of this kind, in two machines; measuring the force of the air, when the water in the basin was at different heights, by the weight which the blast, acting on the arm of a balance, was capable of raising. Taking one of these experiments for a standard, he computed by the rule, what the results of the others ought to have been; but the experiments and calculations ill agreed together. And, indeed, the rule does not seem to be applicable, but in circumstances which can scarcely be expected to occur; for it supposes the machines to be all perfect, and every drop of the water to have its utmost effect, or to carry down with it as much air as it is capable of doing, which cannot be admitted to be the case in any of the blowing machines yet constructed.

In the "*Art des Forges*," are mentioned some observations of Reaumur, of the quantity of air afforded by the wooden bellows. He finds that those used at the iron furnaces yield 98,280 cubic inches, or upwards of five cubic feet of air, at every stroke; and, including the two bellows which act alternately, 240 strokes in a quarter of an hour; which, on a reduction of the French measures to the English, make 1,301,896 cubic inches, or upwards of 753 cubic feet in a minute: this quantity exceeds that which the foregoing calculation gives, for the machines of Dauphiny, above four times; and, therefore, four of the machines should scarcely be able to supply the iron furnace with so much air as the wooden bellows do; whereas two or three are said to be sufficient. Again, the bellows of the iron finery and forge were found to give two thousand and fifty-one cubic inches and a third, at each stroke, and four hundred and twelve strokes in a quarter of an hour; whence the quantity of air in a minute is 458,247 cubic inches, or somewhat more than 265 cubic feet; this is greater than the calculation of the water machine, in the proportion of about three to two, though one of the water machines is found to supply the office of the bellows.

It is not to be supposed that the quantity of air which furnaces require, is confined to any such precise limits, as that two bellows, from their being found to answer sufficiently for one kind of furnace, or even two for one individual furnace, can be concluded to yield quantities of air exactly or nearly equal. The above differences are, perhaps, as little as can be expected in comparisons of this kind, where the effects compared are so indeterminate.

As to the water machines, it is plain that the quantity of air carried down cannot be greater than the spaces between the drops, or divided streams in the pipe, can contain; and that, though the air in these spaces must be considered as being compressed to a certain degree, yet it cannot be supposed compressed into two-thirds of its natural volume, which would be necessary for making the calculation of the wooden bellows and the blowing machine to agree; because such a condensation would require the weight of a column of water of eleven or twelve feet, or the third part of such a column, as is equivalent to the pressure of the atmosphere; whereas, in the Dauphiny machine, though the air was pressed down with the full force of the column of water above the choak, their height is less than three feet, and could not condense it more than one-twelfth part.

In what manner Reaumur computed the air of the wooden bellows, we have no account; it is probable that he judged, as others have done in the same cases, from their capacity; supposing the whole quantity of air they contained to be delivered at every stroke. If so, we can lay no stress on the computation, for neither the wooden nor the leathern bellows, deliver their full contents of air; a considerable space remaining full of air, when the bellows are closed; and this space containing considerably more air than an equal volume of the atmosphere, on account of the air being condensed in them by the pressure of the bellows. I have been informed by a judicious workman, that the bellows of the iron finery retain commonly a third, and sometimes half of their air; and that when lined with wood, so that as little vacant space as possible might be left, he found them to blow much stronger than before.

The strength of the bellows is best judged from the force of the blast itself, and this force may be determined in the method recommended by M. Barthès, already mentioned, by the weight it is capable of raising. He found that in the blowing machine of St. Pierre, the force of the blast issuing from a hole of an inch and a third in diameter, raised the arm of a balance loaded with a weight of twenty-five ounces and a half. He gives some other experiments of comparing the proportionate diminution of its force, according to the diminution of the height of the water, which I shall insert in the original French measures, to avoid unnecessary fractions. The above force of twenty-five ounces and a half, is the maximum of this machine, produced by the full quantity of water in the basin, or a height of forty-eight inches above the choak: with a height of forty-one inches, the weight raised was twenty-two ounces; with a height of thirty-two inches, nineteen ounces; with a height of twenty-eight inches and a half, seventeen ounces and a quarter; with twenty-four inches and a half, fifteen ounces and a quarter; with nineteen inches, twelve ounces and three-eighths; with sixteen inches and two-thirds, ten ounces and a quarter; and with a height of thirteen inches and a half, eight ounces and three-quarters.

It may be observed, that in some of these experiments the water must have been employed to disadvantage; and that, by increasing the height of the water much further than the above limits, in the same machine, we could not expect to produce proportionate augmentations of the force of the blast: for if a certain quantity of water, running with a certain velocity through the choak, be supposed to fill the bore of the pipe, a less quantity, with a less velocity, must leave a vacancy, which will suffer part of the air to escape; and a greater quantity, with a greater velocity, must have some part of it spent ineffectually, for want of sufficient room to spread. Some experiments, to be mentioned hereafter, afford a clear proof of this.

[TO BE CONTINUED.]

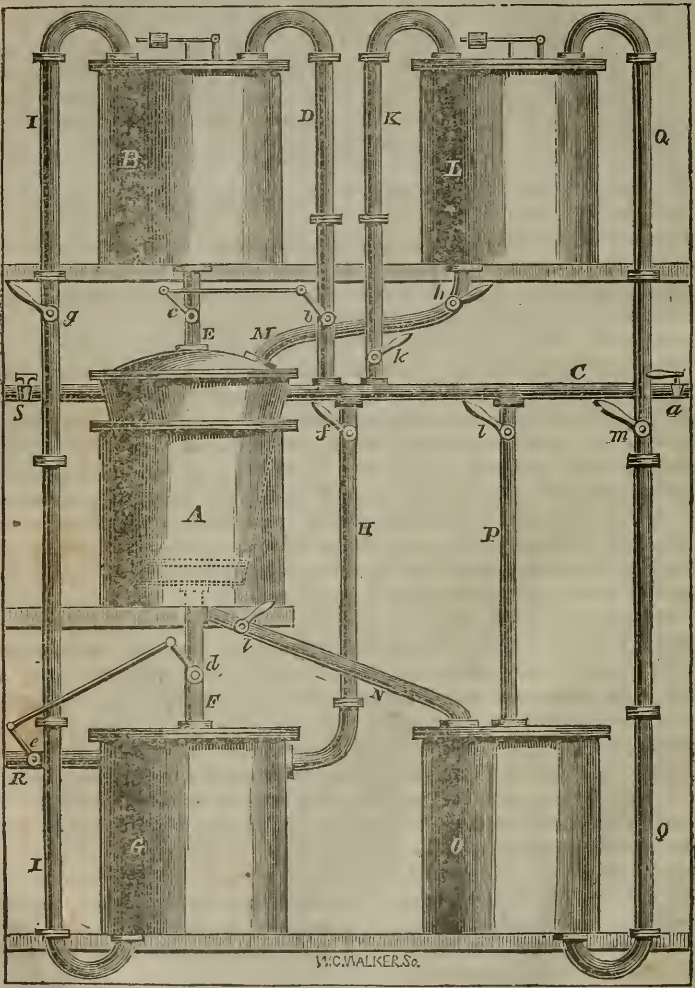
ENGLISH PATENTS.

Account and Description of S. W. Wright's *Patent Machinery, and Process for Washing and Bleaching.*

By this apparatus, the several processes of washing, cleansing, bleaching, and drying, are almost wholly effected by the simple agency of high pressure steam, without the goods being submitted to *rubbing*, so injurious to most fabrics, but especially to those of fine texture. The steam is made not only to act a chemical part in the several operations, but by its expansive force to perform a mechanical one also; to fill, to discharge, and to re-fill at pleasure, a series of vessels with the fluids required in the successive processes; and all these changes are effected, without any other manual aid, but the occasional turning of a few stop-cocks.

The accompanying diagram, must be considered as illustrative of only one eligible mode of performing the operations, as the form and disposition of the vessels, and other parts of the apparatus, may be varied according to circumstances. By this arrangement, the goods to be cleansed, or bleached, are first packed closely into a conical vessel, through which steam is, for a while, caused to pass; the steam is next made to force an alkaline solution through the goods, in order to remove the impurities, or colouring matter, (which operation is repeated as often as may be judged expedient;) hot water is then impelled through the goods, to remove all the alkaline matter; ultimately, steam of a high pressure is forced through to expel the water; the goods are, by this last operation, left nearly in a dry state, and perfectly clean. A subsequent process, that of introducing blasts of cold air through the goods, may also be employed, by which their whiteness will be further improved.

A, is a copper vessel, formed as the frustrum of a cone, at the lower part of which is a perforated false bottom or grating, and below this, the real bottom, from whence a pipe descends. The cotton, linen, or other articles to be operated upon, having been previously soaked in water and rubbed over with soap, are to be closely packed in this vessel, the lid of which is then to be screwed down and rendered steam tight at the junction. In the diagram, this conical vessel is shown, surrounded by a jacket, to prevent the radiation of the heat, but this addition, the patentee does not consider to be absolutely necessary. B is a vessel (which is also of copper, as well



as the other vessels and tubes represented,) containing soap and water, or the usual alkaline solutions of pearl-ash, soda, &c.; C is a pipe leading from a steam boiler, through which is introduced steam, that has been raised to a pressure of 50 lbs. upon the inch, which is at first to be gradually admitted into the apparatus, by partially opening the stop-cock, *a*, when it passes into the vessel A, where it is allowed to act upon the goods therein deposited, for half an hour; after which, the cock *a* may be completely opened, and the full force of the steam be allowed to operate, first, opening the cocks *b*, *c*, *d*, *e*, when the steam will pass up the pipe D, into the vessel B, containing the alkaline solution. The pressure of the steam upon the surface of the liquid in this vessel, will now cause it to descend through the pipe E, into the vessel A, and herein, the steam continuing to press, will force the alkaline liquid through the goods, saturating every part, and carrying dirt and other impurities to the bottom, the liquid passing off through the pipe F, into the receiver G, underneath.

The pressure of steam is next employed to re-fill the vessel B, with the discharged alkaline liquor; for this purpose, the cocks, *b*, *c*, *d*, *e*, are to be closed, and the cocks *f* and *g* to be opened; the steam will now pass down the pipe H, and operate with its full pressure upon G, thereby forcing the liquid up the pipe I I, again into B; from whence it is forced again through the goods in the vessel A, repeating the operation as often as it may be found necessary, in order to perfectly cleanse them; the number of times it will require, will depend upon their degree of foulness, &c. which can only be determined by experience: for the ordinary washing of body linen, twenty times have been found sufficient.

Having now removed all the dirt and other impurities from the articles operated upon, the next process is that of rinsing, which is effected by closing the cocks, *b*, *c*, *d*, *e*, *f*, *g*, and opening those at *i*, *k*, and *h*, when the steam from C, passes up the pipe K, into the vessel L, which is filled with clean hot water; the full pressure of the steam being now transferred to the surface of the hot water, forces it through the pipe M, and through the goods in the conical vessel A, carrying away the alkaline and other impurities through the pipe N, into the vessel O. The hot liquor in O, is now to be returned into L, by *i*, *k*, *h*, and opening those at *l* and *m*, when the steam passes down the pipe P, and forces the liquor contained in O, up the pipe Q Q, again into L, for the renewal of the operation, this part of the process being also repeated as often as may be deemed desirable, which will depend upon the condition of the goods.

The washing and rinsing having been performed, drying forms the next part of the process, which is effected by closing all the cocks except those at *a d e*, and allowing steam at a reduced pressure to pass direct from *c* into the vessel A again, by which all the water is driven out from the goods, leaving them in nearly a dry state, the steam passing off through the pipe F, and escaping at R. In this part of the process it is necessary to observe that steam should not be employed at a greater pressure than 20 lbs. to the inch, and that its action should not be prolonged beyond the time required for driving off the water.

For the bleaching of piece goods, in lieu of the circular-sided vessel A, the patentee recommends one with straight sides, with its area diminishing downwards: in this vessel the goods, having been carefully folded, are to be packed closely together, and, in addition to the steaming and washing by means of alkaline solutions, currents of cold air, produced by a blowing machine, are to be admitted through the pipe S, which it is said greatly assists in whitening the fabric. [*Register of Arts.*

Description of the Diving Apparatus, patented by W. H. James, Esq.

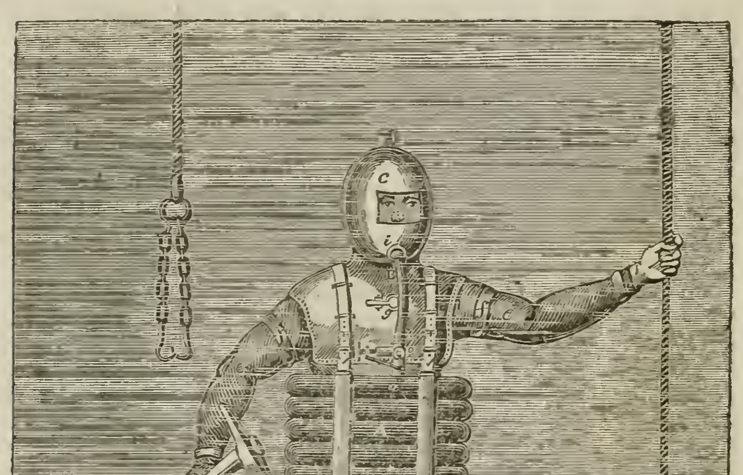
A very ingenious attempt has been made by Mr. W. H. James, to construct a diving apparatus that will enable the wearer to descend to the bottom of deep water, and remain there for half an hour, or more, to execute a variety of important operations, altogether impracticable without it: such as the recovery of sunken property; the obtaining of coral and pearls; building under water, &c. For some of these purposes the diving bell has of late years been employed, but as the workmen who descend can only carry on their work within its narrow limits, their operations are very much restricted. To overcome this inconvenience and give a more extended range to the actions of the diver, so as to render them more effective and useful, has been the object of Mr. James, in his invention, which has recently become the subject of patent right.

The diver is attired with a portable vessel, (placed around and adapted to the figure of his body,) which is filled with condensed atmospheric air, and by means of a simple arrangement of pipes and judiciously constructed valves, he is enabled to supply himself with fresh air for respiration during the time he is under the water.

It must be obvious that an apparatus on these principles will admit of considerable variations in the construction, which have therefore been contemplated by the patentee in his specification; we restrict the description to one of the forms, and its mode of operation.

The accompanying engraving gives a front view of the diver, fully equipped with the apparatus, and represents him as engaged in recovering from a wreck, at the bottom of the sea.

A is the vessel to contain the condensed air, which is to be filled by means of a condensing air pump; it consists of a series of strong metallic tubes, or one continuous tube, coiled elliptically round the body, and connected together by bands, to which straps are attached to secure it in its position. At *a* is a valve opening inwardly, through which the air is to be forced by a condensing pump, until it has acquired the desired degree of density; or the vessel may be filled, by attaching to the valve *a*, a reservoir already filled with condensed air, and allowing it to flow through the same until the pressure becomes equalised. The degree of density required will of course be determined by the time it is proposed for the diver to remain under water. (With a vessel of the magnitude exhibited, thirty atmospheres are considered sufficient for an hour's consumption.) B is a tube made of caoutchouc (or Indian-rubber) for conveying the air into the water-tight helmet C, by means of a valve so contrived as to be under the complete and easy control of the diver. The helmet may be made of any water-tight material, but thin copper is recommended; it is provided with a strong plate of glass in front to enable the diver to see surrounding objects. Inside the helmet is a flexible tube *c*, with a mouth-piece at the end, which comes near to the mouth of the diver; through this the air is discharged from his lungs, which passes out of the valve *d*, shown in the upper part of the helmet. At the lower part of the helmet and round the breast, back, and shoulder, a water-proof garment *e* is attached, fitting closely round the body of the wearer, and made fast by elastic bandages *f*. To secure the diver from being inconvenienced by the pressure of the air within the helmet becoming too great, a safety valve is inserted about the breast to allow the desired portion to escape.



The weight of the apparatus may amount to about 50 lbs., but as this will not be found sufficient to give stability to the diver, weights must be attached to the lower parts of the apparatus, two of which are represented in the drawing.

The patentee likewise contemplates the employment of the same apparatus, *divested of the weights*, in mines and other places filled with deleterious gases, wherein it may be used with perfect safety, and great advantage.

Description of a Machine for Hulling Rice, invented in the United States, and patented in England, by Melvil Wilson, *agent of the invention. Enrolled, June,* 1827.

The apparatus by which the natives in most countries, where rice is grown, deprive the grain of its husk, is so rude and ineffective, that it is a matter of surprise the experience and wants of society have not, until lately, caused the introduction of contrivances better calculated for the purpose. A machine for effecting this operation must necessarily be very simple, as the act required consists merely in rubbing the grains against one another, or in contact with some other substance. Of these two modes, the latter is attended with the disadvantage of causing a deposition of small particles from the foreign substance (detached from it by collision) upon the grain; to remove which an additional operation becomes necessary, or the rice would not be proper for food. The inconvenience just stated, has, we know, resulted from an attempt to clean rice in the manner that many articles of manufacture are cleansed, viz. by turning the grain round in a barrel fixed upon a revolving axis, in which was also deposited a quantity of pebbles; the husking was, however, thus quickly accomplished, and the pebbles were separated with facility by throwing them upon a sieve, the meshes of which were adapted to let only the rice pass through, and to detain the stones.

To conduct the operation of husking simply by the collision of the grains of rice against one another, has not only the advantage of *superior cleanliness*, but, we think, also that of *greater expedition.* On this principle is constructed the machine we have to describe, which is the invention of a foreigner residing at New York, and has been patented in this country by Mr. Wilson, as the commercial agent of the inventor. The enrolled specification of this patent is very concise, and describes merely a portion of the machine, as represented on the other side of the page, the additions being made by us to render the apparatus more complete, and worthy of adoption in the Colonies, not doubting that the patentee will be disposed to grant licenses for the use of that portion of the apparatus claimed by him as original; and, as respects our additions, they are free gifts to whomsoever they may be useful.

The patented portion consists of a long hollow cylinder of metal or wood; around the interior surface of which are fixed, at equal distances and in parallel circles, a series of angular bars, projecting towards the centre or axis of the cylinder; this cylinder revolves loosely on a central shaft, which passes through it, and is provided with a similar number of bars, pointing (as radii) from the centre to the circumference, and passing alternately between the bars in the cylinder, so as to leave, when at their nearest proximity, (or in opposition) an inch free space between them. Thus disposed, the cylinder is placed in an inclined position, the rice is allowed to enter it at the top, while the cylinder is made to revolve with a "slow motion" *in one direction*, the axis moving at the same time at "a high speed," and *in a contrary direction*; consequently, as the rice passes through the cylinder, the grain will be considerably agitated and turned about; and, by that means, the husks will be *rubbed* off before passing out at the lower end of the cylinder.

To render the construction of the interior of the cylinder perfectly understood, we have annexed the diagrams in the margin.

Fig. 1 represents a plan of the cap of the cylinder, not fixed thereto, nor to the axis, which passes through it, but to the framing which supports the hopper; it serves therefore to guide the grain into the cylinder, and to keep out dirt and other adventitious substances.

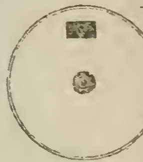

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Fig. 2 is called, in the specification, "a socket wheel;" it is fixed directly under the cap to the cylinder, and the axis passes through the socket, which serves, therefore, as a bearing for both the axis and the cylinder, permitting them to revolve freely in contrary directions. For the convenience of removal, this wheel is made to divide in two parts, as shown, which are bolted together when in use.

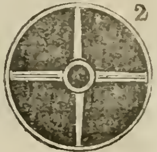
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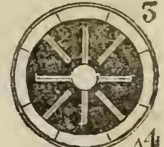
Fig. 3 gives a transverse section of the cylinder and axis, each of which being shown as provided with four bars, that number being fixed in each parallel circle, and alternately as respects those on the cylinder and those on the axis. This section likewise shows the cylinder as made of wood (with hoops round it) and that it is composed of eight distinct pieces or segments; on each of the eight segments is fixed a longitudinal row of similar bars, though only four (the number in one circle) are brought into view to prevent confusion.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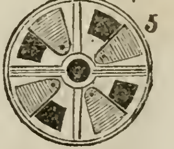
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Fig. 4 is a transverse section of one of the before mentioned bars, showing that they are of the figure of a quadrangular prism, that shape being preferred by the patentee for the purpose in question.

Fig. 5 is a plan of the bottom of the cylinder; it is formed in part like the socket wheel, described in Fig. 2, but the spaces between the spokes are closed; in each of these compartments a large aperture is made for the egression of the grain, which is regulated at pleasure by sliding doors to each, as represented.

The specification states, that the cylinder may be worked in either a vertical, an inclined, or a horizontal position, and with that view the sketches attached to it (the specification) are apparently designed to exhibit a method of altering the position at pleasure;* the upper extremity of the axis of motion appears (by dotted lines) to be resting on a pivot beam, and to the lower extremity is a regulating screw, by which that end may be elevated or depressed at pleasure; the question of the best position of the cylinder is, however, decided by the patentee himself, who prefers it at an inclination of about 45°: we have accordingly thus placed it in our drawing, with the omission of the apparatus for altering its position.

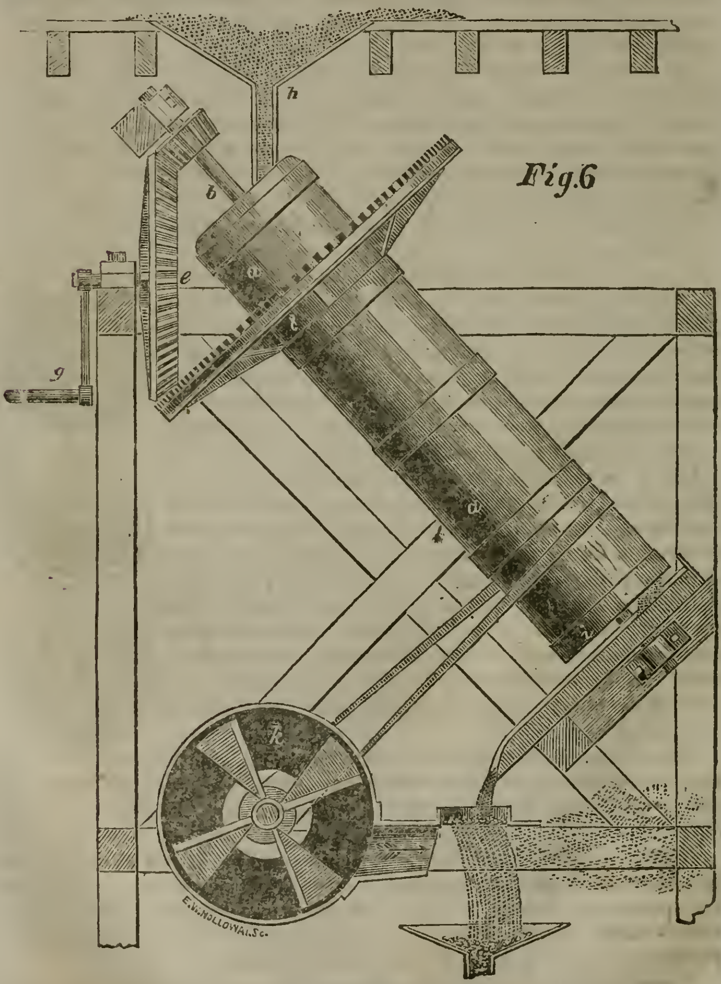

Fig. 6

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* If the alterations in the position of the cylinder be designed to accelerate or retard the passing through of the rice, that object is effected by enlarging or decreasing the apertures at bottom, by the sliding doors, as before mentioned.

No gearing for communicating motion to the cylinder and axis is either shown in the sketches, or described in the specification; we have therefore taken the liberty of placing such as appeared to us the best calculated to effect the motion intended, by the simplest means, and in the least compass; we are aware that the combination of the two wheels and pinion shown, is peculiar, perhaps never before proposed or attempted; nevertheless, we are convinced that they will, properly constructed, perform well.

At Fig. 6 the machine is shown complete.—*a a* is the husking cylinder; *b* the axis, turning in plummer blocks at *c c;* on the axis, *b*, is fixed a slightly-bevelled pinion, *d;* at *e* is a bevelled wheel, and at *f* a faced wheel. Motion being given to the winch, *g*, by manual force (or other power,) a "high speed" is thereby communicated to the shaft in one direction, and a "slow motion" to the cylinder in a contrary direction: during which the rice from the hopper *h* (shown in section) is continually pouring into the top of the cylinder, and as fast as it is husked, running out at the bottom, *i*. Here ends the process as described in the specification, but we have thought it not amiss to propose separating the husks or chaff from the rice as it runs out of the cylinder; accordingly, we suggest the addition of a blast cylinder or winnow, at *k*, which may be actuated by a band passing round the cylinder, *a*, or round a pulley at the back of the bevelled wheel, *e;* the husks may thus be completely separated from the grain at a single operation, in one connected machine, by a very slight increase of power, instead of two operations with distinct apparatus.

[*Ib.*

Account of the Apparatus for cleaning paddy, or rough Rice, Patented by MESSRS. LUCAS *and* EWBANK. Enrolled, May, 1827.

THE specification of this patent states, that it is for improvements upon a patent, granted in the year 1819, for the same purpose, to Mr. Ewbank, one of the parties in the present grant, which consists in some slight variations from the former process; found, nevertheless, to be essential to the perfection of the operations, and a more economical mode of preparing the rice for market.

The specification of the present patent, briefly recites the process described under the former, by which the improvements subsequently made, will be better understood; it consisted as follows:

The rough rice, or paddy, was first cleansed from dirt and other foreign matter, by passing it over a screen, which, detaining the rice, allowed the impurities to pass through. The paddy in this state was taken to mill-stones, set at a proper distance apart, to rub off the external shells or husks; the husks are next blown away by a fanning machine; the rice thus partially cleaned, is then deposited in mortars, where it is beaten and triturated for depriving it of the thin under pellicle, or red skin; and when the trituration has been carried far enough, the contents of the mortars are sifted upon a "sloping and revolving screen," which is composed of three distinct wire cloths, of different degrees of fineness. The finest under cloth, allows the dust or flour to pass through, but detains the broken rice; the second or middle cloth, separates the broken, and detains the whole rice, while the coarsest upper cloth, allows only the whole rice, or husked grain, to pass through, and detains the unhusked, which is taken back to the mill-stones, to be operated upon again. The rice, still but imperfectly clean, was afterwards taken to the polishing and whitening machine, which consists of two cylinders placed concentrically; the exterior cylinder was fixed or stationary, and the interior one, which was made to revolve, was covered with sheep skins, with the wool on, and stretched upon boards or other proper framing, with the wool on the outside. Between these two cylinders the rice was put, and the inner cylinder being made to revolve, (by the action of a steam engine or other prime mover,) the rice was brushed by the constant friction of the wool, and thereby polished and whitened; in other words, brought to a state fitted for the market.

The foregoing, comprise the substance of the processes described in Mr. Ewbank's specification of the patent of 1819. The second patent, granted jointly to Messrs. Lucas and Ewbank, in May, 1827, relates to certain improvements upon the former, and is confined to a superior method of treating the rice, after it has been deprived of the external shell or husk by the operation already described, or by any other mode. This improvement is founded upon the observation, that the thin under pellicle of a reddish colour, which remains upon the grain after it has been shelled, is of a glutinous or gummy nature, and that the beating and triturating it in the mortars, occasioned the mass to become very sticky, and difficult to operate upon, towards the close of the process; and, that that portion of the rice which had already been stripped of its red pellicle, became injured in its colour, by continuing the process until the remainder in the mass had also been deprived of their red pellicles. To avoid this inconvenience, Messrs. Lucas and Ewbank now use successively, two or more sets of mortars, for conducting the last mentioned operation, in this manner: when the gummy or glutinous matter begins to disengage itself, (which is immediately manifested by the rice moving sluggishly under the pestles,) it is to be taken out of the first set of mortars, and carried to a second set, wherein is to be mixed with the rice, a quantity of the external husks well dried, in the proportion of one-fourth or two-fifths in bulk to that of the rice. The triturating and beating process is then renewed upon this mixture, the dry husks greatly assisting in cleaning and whitening the grain. After this, the mass is to be fanned and screened, to separate the refuse, when the rice is taken to the polishing machine as before described, which terminates the process. The fanning and screening is to be done as often as may be found necessary, between each triturating process, which may extend to three or four distinct operations, according to the quality or state of the rice.

The patentees observe in their specification, that they consider the stickiness of the rice to be owing to the humidity of the climate of this country, or to a certain dampness which it acquires in its voyage, as the difficulty they experience, has not been noticed in the rice mills employed in the Carolinas and elsewhere.

[*Ib.*

Account of the Process invented by J. G. Christ, *for Enamelling Cards, and for which he has obtained a Patent.*

The process for manufacturing these beautifully white enamelled cards is as follows:

One pound of parchment cuttings, a quarter of a pound of isinglass, and a quarter of a pound of gum arabic, are to be boiled in an iron pot, or other vessel, in 24 quarts of pure water, until the solution is reduced to 12 quarts, when it is to be taken off the fire and strained, clear. The solution, of this consistence, is then to be divided into three equal portions of four quarts each; to the first of these portions is to be added 10 pounds of *pure* white lead, (previously ground fine in water,) which is called *Mixture No.* 1; to the second portion, 8 pounds of pure white lead, forming *Mixture No.* 2; and to the third is to be added 6 pounds of pure white lead, making *Mixture No.* 3. The sheets of paper are then to be stretched out flat upon boards, and brushed over with a thin coat of No. 1 mixture, with a common painter's brush; the paper is then to be hung up to dry for 24 hours: after this, the paper is in a similar manner to receive a coat of No. 2 mixture, and dried again for 24 hours; the paper is then to undergo the same process with No. 3 mixture, and dried for 24 hours more. It is now to be printed with the engraved plate, and the press board used for the purpose is directed to be of smooth cast-iron, instead of wood. The printing being completed, the paper is to be hung up a fourth time for 24 hours, to dry; after this, it undergoes the final operation of receiving its high gloss, which consists in laying the work with its face downwards on a highly-polished steel plate, and then passing both together, with great pressure, between a pair of cylindrical rollers: and thus the beautifully polished surface of the steel is transferred to the composition on the paper, which closely resembles the finest white enamel.

It is to be regretted, that this enamelled surface is not very durable, as it comes off after wetting it slightly with the finger. A considerable competition in the preparation of enamelled paper, or cards, has been excited among the manufacturers, by the eminent success which has attended Mr. Christ's career, in the undertaking: former processes for producing similar effects have been renewed and encouraged by the trade; and we have particularly noticed that the cards sent out by Messrs. Shaw and Sons, of Fetter Lane,—and Mr. Alfred Storer, of Pentonville,—while they possess the high polish of Mr. Christ's manufacture, will sustain bending without cracking, and retain their polish after being wetted. [*Ib.*

Description of a Patent Air Engine, invented by Robert *and* James Stirling, *of Glasgow*. Enrolled, July 20, 1827.

Although it is well known that the elastic force of fluids, generally, is increased by an increase of temperature, yet, very few attempts have been made to render available this increased elastic force, in any fluid except water, the vapour of which has long occupied the attention of the ablest engineers; hence the numerous improvements and modifications of steam engines, which have been applied to produce motion in machinery. Still, however, a few plans have been proposed for applying the elastic force of air and other fluids, and we have now the pleasure of laying before the public, a description of Messrs. Stirlings' air engine for this purpose.

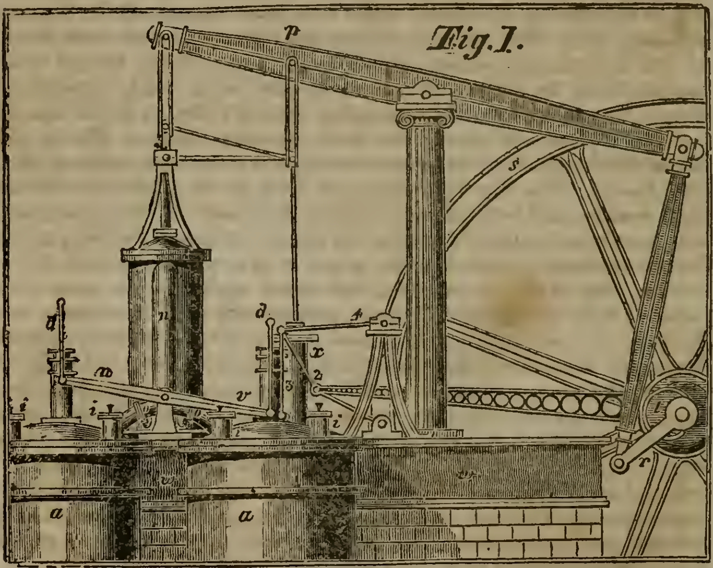
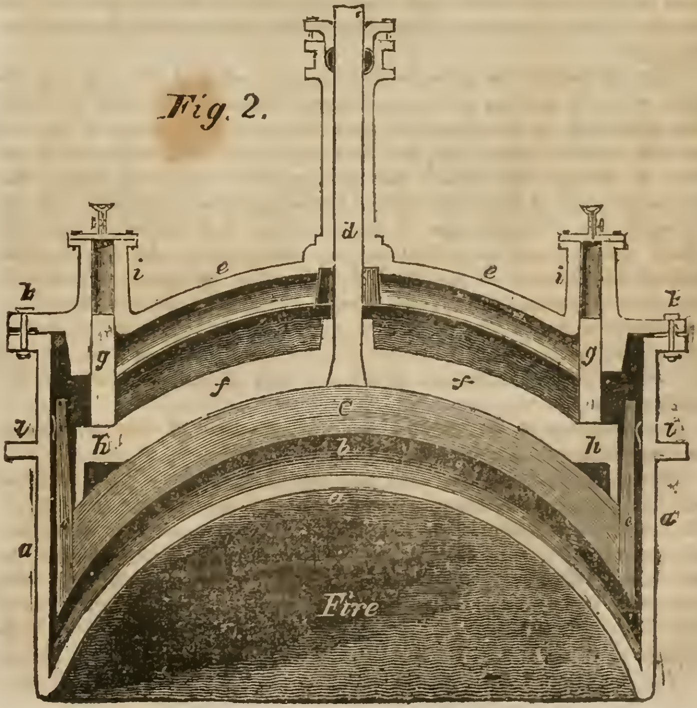


Fig. 1.

This machine resembles the steam engine in the construction and application of many of its parts, such as the cylinder and piston, the reciprocating beam and parallel motion, and the fly wheel and crank, as above represented by Fig. 1. Motion is communicated to the piston in the cylinder, *o*, by alternately heating a portion of air connected with one side of the piston, and at the same time cooling that in connexion with the other. And this is effected by means of the air vessels *a, a;* one of which communicates with the upper part, and the other with the lower part of the cylinder, through the nozles *m m;* the pipe *n*, forming the communication between one of the nozles *m*, and the top of the cylinder.

Fig. 2 represents a section of one of the air vessels, whose sides are cylindrical, and top and bottom spherical. This air vessel, which is made of cast-iron, and supported in the brick work, by the projecting ledge *l l*, is furnished with a plunger, *c C c*. The top and bottom of the plunger is made of strong sheet-iron, perforated with very numerous small holes, to admit the air. The interior of the plunger is filled with very thin plates of sheet iron, so bent, as to prevent their flat surfaces from coming in contact, that the air may have a free passage between them. These are also perforated with small holes, which holes are not placed opposite to each other, but so arranged, as to cause the air to pass through the plunger in a zigzag direction. The patentees state, that the interior of the plunger may be filled up with pieces of brick, gravel, or other granulated substance, instead of the thin sheet iron. The plunger is formed circular, to fit the top and bottom of the air vessel, when drawn up and down. The rim *c c*, of the plunger, which moves in a cylindrical receptacle at the circumference of the air vessel, as represented, is not perforated as the other part. It is kept steady by the spring *u u*, consisting of thin sheet iron, attached at its upper edge to the rim *c c;* a number of slits are made from the lower edge of the belt, to admit of its being bent outwards, to rest against the air vessel and act as a spring. The plunger is also kept steady in its ascent and

Fig. 2.



descent, by the plunger rod *d*, passing through the stuffing box at the top of its case, and the guide rods *g g*, which work in the guide cases *i i*, figs. 1 and 2. The guides are fixed to a ring *h h*, which is attached to the plunger, and the plunger rod by the arms *f f*, four in number; they are supplied with oil, by an oil cup and stop-cock at the top of their cases. The top *e e* of the air vessel, is flanched down in the manner represented at *k*, with a thin ring of sheet lead between the flanches, to keep the joining air-tight.

The lower part of the air vessel is heated by a fire place under it, and its upper part kept cool by a current of cold air, by water, or by other means.

The plunger rods of the air vessels *a a*, fig. 1, are attached by slings to the ends of the beam *v*, so that the motion which elevates one plunger in one of the vessels, depresses that in the other.

When the plunger is raised, the cold air in the upper part of the air vessel, will be heated in passing through the interstices of the plunger in its ascent, which has itself been heated on reaching the lower, or hot part of the vessel, and during this time the air in the other vessel will be cooled, by passing through the interstices of the plunger in its descent, which has itself been cooled by reaching the upper, or cold part of the vessel. These changes of temperature are further augmented, by portions of the air being alternately changed from the hot to the cold, and from the cold to the hot parts of the vessels, by the alternate occupation of the hot and cold parts by the plunger.

Now, as one of the air vessels is connected with the top, and the other with the bottom of the working cylinder *o*, there will be a motion produced on the piston, by the alternate application of the expansive force of heated air, and this motion is communicated to the beam *v*, through the piston rod and parallel motion *q*, and to the connecting rod at the other end of the beam, and the crank *r* to the fly-wheel *s s*. On the axis of the fly wheel is fixed an eccentric *t*, which communicates motion to the plungers in the air vessels, through the system of levers 1, 2, 3, 4, and the beam *v*: and this motion is adjusted, so that the change of the plungers shall be effected whenever the piston reaches the top, or bottom, of the cylinder; thus applying to that end of the cylinder where the piston is, the hot air, which, by its increased elasticity, will drive the piston to the other end.

The diameter of the nozle *m* is $\frac{1}{5}$ the diameter of the cylinder *o*, and one-fifteenth of the diameter of the air vessel *a*.

This engine is also furnished with an air pump, the piston rod of which is shown at *x*, for condensing air into the air reservoir *w w*. The air is permitted to pass through self-acting valves into the nozles *m m*, and thence into the cylinder *o*, or the air vessels *a a*, but not permitted to return from these vessels or the cylinder into the reservoir, which is also provided with a safety valve for the escape of superfluous air, when more is pumped in than is necessary to supply the air vessels. The diameter and length of the stroke of the air pump are half those of the cylinder, but this appendage is not required to be kept constantly at work.

The patentees state, that any of the permanent gases may be employed, instead of atmospheric air. They do not claim as their invention, the application of these bodies to produce motion; but merely the above arrangement of machinery, for applying the elastic force of gaseous bodies to the production of motion. [*Ibid.*

Description of the Itinerant Gasometer, patented by Messrs. Coles & Nicholson, *of Manchester.* Enrolled, August, 1827.

A gas company having been some time since established in Manchester, for the preparation and delivery of *compressed gas*, in Mr. D. Gordon's portable gas lamps, it has very recently been determined by the company, that an important addition might be made to their useful establishment, by combining with it the means of delivering gas in its natural volume, under common atmospheric pressure; an invention for the purpose has been made, and a patent granted for it to Messrs. Coles and Nicholson.

The specification of this patent, gives an elaborate explanation of various modifications of the apparatus, and of several ingenious modes of making the recipient, gas-tight; but our present intention, is merely to give an outline of the construction of that which we believe is adopted by the company.

Fig. 1 represents a plan of the cart with the top of it removed. Fig. 2, a side elevation; and Fig. 3, a front elevation. Fig. 4 is merely an enlarged section of the box marked *d* in Fig. 2.

The recipient is composed of two distinct parts or halves, *a* and *b;* the upper part *a*, is made of some flexible material, impervious to gas, and the lower part *b*, of some stiff or comparatively inflexible substance; when the vessel is empty, the part *a* turning itself inside out, falls down inside of *b*. The vessel is filled, by forcing the gas from the works, through a pipe which is screwed into a nozle at *f*, provided with a stop-cock, which is turned off after the recipient is fully inflated, and the supply pipe from the works, removed. The machine then sails along the streets, and stopping at a customer's door, one end of a flexible pipe is screwed into the gas-holder of the house, and the other end into a nozle in the box *d*, which communicates with the interior of the recipient by means of intermediate valves, shown at Fig. 4. The gas exhauster *c*, is then put in motion by the handle at top, which at every exhausting stroke, is filled with gas from the gas-cart, through the valve *g*, Fig. 4, and by the forcing stroke is discharged through the valve *h*, and along the flexible pipe, into the gas-holder of the house, until the required quantity is transferred. The gas-cart thus proceeds from house to house, until the whole *load* is discharged. Along the bottom of the cart is a pipe *e*, connected at one end with the stop-cock *f*, and at the other with the box *d* of the exhauster, and perforated with numerous small holes, for the purpose of allowing the passage of the gas along the bottom of the cart, when the flexible top lies over it.

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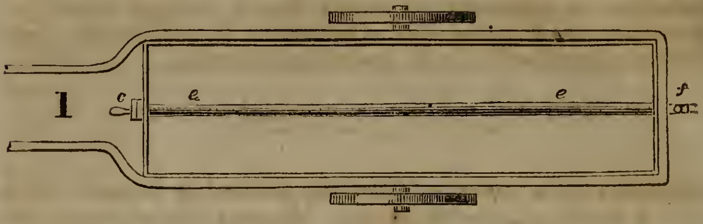

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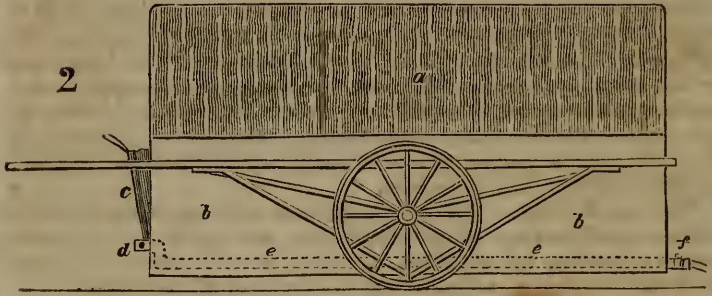

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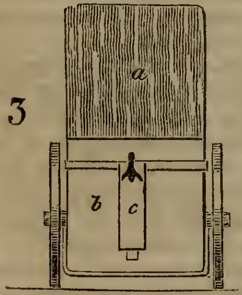

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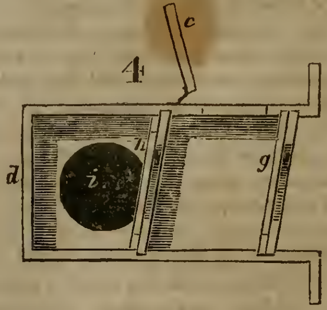

On Chloride of Lime, or Bleaching Powder. By Andrew Ure, M. D., F. R. S., &c.*

Chloride of lime, the bleaching salt or bleaching powder of Mr. Tennant, is called, in commerce, oxymuriate of lime.

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* In the list of premiums offered by the Franklin Institute, for the present year, will be found one for chloride of lime. We have, therefore, thought this a fit opportunity for publishing the article on this subject from Dr. Ure's Dictionary of Chemistry. Editor.

In the researches which I have made, at many different times, on the nature of the chloride of lime, I have generally sought to combine the information flowing from both synthesis and analysis; that is, I first converted a known portion of hydrate of lime into bleaching powder, and then subjected this to analysis. Among the results of experiments in my note-book of 1815, I find the following: 500 grains of unslacked quicklime, in fine powder, from Carrara marble, were exposed in a glass globe to a copious steam of chlorine, previously passed through a little cold water, for four days. The increase of weight was noted from time to time, and was found, at the end of that period, to be only 30 grains, which subsequent examination showed to be due to a little hydrated chloride; the few grains of water requisite having been derived from the great body of undried gas which had been transmitted. In May, 1817, an experiment is recorded, in which 400 grains of a hydrate of Carrara lime, equivalent to 291.28 grains of dry lime, were exposed for two days to a stream of chlorine, washed in water of 50°, and refusing to absorb more gas, were found heavier by 270.5 grains. Supposing this augmentation to be chlorine, we shall have the composition of the powder, by the synthetic mode, as follows:

Chlorine,			40.34
Dry lime,	43.46	Hydrate,	59.66
Water,	16.20		
			100.00

This powder was analyzed, by acting on a given weight of it with dilute muriatic acid, in a pear-shaped glass vessel. Care was taken to remove the whole disengaged chlorine, without letting any liquid escape. The lime was converted into carbonate, by a solution of carbonate of ammonia. The following are the results of two independent analytical experiments:

	1st Experiment.	2nd Experiment.
Chlorine evolved,	40.60	39.40
Lime,	42.27	42.22
Water,	17.13	18.38
	100.00	100.00

I have reason to believe the second experiment the more correct of the two, and if the synthetic result be compared with it, we are led to infer that the very great body of undried chlorine passed over the lime, had deposited two per cent. of water. By other experiments I satisfied myself, that dilute muriatic acid expelled nothing but pure chlorine, for the whole gas disengaged is absorbed on agitation with mercury. It does not appear possible to reconcile the above chlorides to a definite atomic constitution. The following experiments were made with much care last spring:

200 grains of the atomic protohydrate of pure lime were put into a glass globe, which was kept cool by immersion in a body of water

at 50°. A stream of chlorine, after being washed in water of the same temperature in another glass globe, connected to the former by a long narrow glass tube, was passed over the calcareous hydrate. The globe with the lime was detached from the rest of the apparatus from time to time, that the process might be suspended as soon as the augmentation of weight ceased. This happened when the 200 grains of hydrate, containing 151.9 of lime, had absorbed 130 grains of chlorine. By one analytical experiment it was found, that dilute muriatic acid expelled from 50 grains of the chloride 20 grains of chlorine, or 40 per cent.; and by another, from 40 grains 16.25 of gas, which is 40.6 per cent. From the residuum of the first, 39.7 grains of carbonate of lime were obtained by carbonate of ammonia; from that of the second, 36.6 of ignited muriate of lime. The whole results are therefore as follows:

	Synthesis.	1st Analys.	2nd Analys.	Mean.
Chlorine,	39.39	40.00	40.62	40.31
Lime,	46.00	44.74	46.07	45.40
Water,	14.60	15.26	13.31	14.28
	100.00	100.00	100.00	100.00

Though the heat generated by the action of the dilute acid has carried off, in the analytical experiments, a small portion of moisture with the chlorine, yet their accordance with the synthetic experiment is sufficiently good to confirm the general results. The above powder appears to have been a pure chloride, without any mixture of muriate. But it exhibits no atomic constitution in its proportions.

To 200 grains of that hydrate of lime, 30 grains of water being added, the powder was subjected to a stream of chlorine in the above way, till saturation took place. Its increase of weight was 150 grains. It ought to be remarked, that in this and the preceding experiment there was no appreciable pneumatic pressure employed, to aid the condensation of the chlorine. In the last case, we see that the addition of 30 grains of water has enabled the lime to absorb 20 grains more of chlorine, being altogether a quantity of gas nearly equal to that of the dry lime. Thus an atom of lime seems associated with 7-9ths of an atom of chlorine. Analysis by muriatic acid confirmed this composition. It gave,

Chlorine,	39.5	= 51.3 cubic inches.
Lime,	39.9	
Water,	20.6	
	100.0	

I next exposed some of this powder to heat in a small glass retort, connected with the hydro-pneumatic trough. Gas was very copiously disengaged, at a temperature far below ignition, the first portions coming off at the heat of boiling water; 100 measures of the collected gas being agitated with water at 50° F., 63 measures were absorbed, and the remaining 37 measures were oxygen, nearly pure. The smell of the first evolved gas was that of chlorine, after which the odour of euchlorine was perceived, and latterly the smell nearly ceased, as the product became oxygen. Having thus ascertained the general products, I now subjected to the same treatment 100 grains of the same powder (that last described,) in a suitable apparatus; 30 cubic inches of gas were obtained from it, in a series of glass cylinders, standing over water at 50°. The first received portion was chlorine, nearly pure, but towards the end, when the heat approached, or was at ignition, oxygen became the chief product. The residuary solid matter yielded to water a solution of muriate of lime, containing 30 grains of the dry salt, equivalent to about 15 of lime. But the chloride, both by synthesis and analysis, seemed to contain in 100 grains 51.8 cubic inches of chlorine, (corresponding to 25.9 of oxygen,) with 39.9 of lime. Thus the volume of the evolved gas proves, independent of other considerations, that a considerable portion of chlorine came off, without dislodging the oxygen from the calcium; and as in subsequent experiments this volume was found to vary with the strength of the powder, and the mode of heating it, this method of analysis becomes altogether nugatory and delusive. The truth of this conclusion will still further appear on reflecting, that an uncertain portion of chlorine is condensed in the water of the trough, and that most probably a little euchlorine is formed at the period when the gaseous product passes from chlorine to oxygen. Thus, of the 39.9 grains of lime present in the chloride, 24.9 seem to have merely parted with their chlorine, while the other 15 lost their oxygen, equivalent to 12$\frac{2}{3}$ cubic inches, or 4.3 grains, and the remaining 10.7 of calcium combined with 19.3 of chlorine, to constitute the 30 grains of ignited muriate of lime. But 19.3 grains of chlorine form 25.3 cubic inches; hence $51.8 - 25.3 = 26.5$ is the volume of chlorine disengaged by the heat, to which, if we add 12$\frac{2}{3}$ cubic inches of oxygen, the sum 39.16 is the bulk of gas that should have been received. The deficiency of 9.16 cubic inches is to be ascribed to absorption of chlorine (and perhaps of euchlorine,) by the water of the pneumatic trough. In the above case, about one-half of the total chlorine came off in gas, and the other half combined with the basis of the lime, to the exclusion of its oxygen. I have observed, that the proportion of chlorine to that of oxygen given off by heat, increases, as one may naturally imagine, with the strength of the bleaching powder. When it is very weakly impregnated with chlorine, as is the case with some commercial samples, then the evolved gas consists in a great measure of oxygen.

Of the Manufacture of Bleaching Powder.

A great variety of apparatus has been, at different times, contrived for favouring the combination of chlorine with slacked lime, for the purposes of commerce. One of the most ingenious forms was that of a cylinder, or barrel, furnished with narrow wooden shelves within, and suspended on a hollow axis, by which the chlorine was admitted, and round which the barrel was made to revolve. By this mode of agitation, the lime-dust being exposed on the most extensive surface, was speedily impregnated with the gas to the requisite degree. Such a mechanism I saw at MM. Oberkampf and Widmer's celebrated *fabrique de toiles peintes*, at Joüy, in 1816. But this is a costly refinement, inadmissible on the largest scale of British manufacture. The simplest, and in my opinion the best, construction for subjecting lime-powder to chlorine, is a large chamber, eight or nine feet high, built of siliceous sandstone, having the joints of the masonry secured with a cement composed of pitch, rosin, and dry gypsum, in equal parts. A door is fitted into it at one end, which can be made air-tight by strips of cloth and clay-lute. A window in each side enables the operator to judge how the impregnation goes on by the colour of the air, and also gives light for making the arrangements within, at the commencement of the process. As water-lutes are incomparably superior to all others, where the pneumatic pressure is small, I would recommend a large valve, or door, on this principle, to be made in the roof, and two tunnels of considerable width at the bottom of each side wall. The three covers could be simultaneously lifted off by cords passing over a pulley, without the necessity of the workman approaching the deleterious gas, when the apartment is to be opened. A great number of wooden shelves, or rather trays, eight or ten feet long, two feet broad, and one inch deep, are provided to receive the riddled slacked lime, containing generally about 2 atoms of lime to 3 of water. These shelves are piled one over another in the chamber, to the height of five or six feet, cross-bars below each keeping them about an inch asunder, that the gas may have free room to circulate over the surface of the calcareous hydrate.

The alembics for generating the chlorine, which are usually nearly spherical, are in some cases made entirely of lead, in others, of two hemispheres joined together in the middle, the upper hemisphere being lead, the under one, cast-iron. The first kind of alembic is enclosed, for two-thirds from its bottom, in a leaden or iron case; the interval of two inches between the two being destined to receive steam from an adjoining boiler. Those which consist below of cast-iron, have their bottom directly exposed to a very gentle fire; round the outer edge of the iron hemisphere, a groove is cast, into which the under edge of the leaden hemisphere sits, the joint being rendered air-tight by Roman or patent cement.* In this leaden dome there are four apertures, each secured by a water-lute. The first opening is about ten or twelve inches square, and is shut with a leaden valve, with incurvated edges, that sit in the water-channel at the margin of the hole. It is destined for the admission of a workman to rectify any derangement in the apparatus of rotation, or to detach hard concretions of salt from the bottom. The second aperture is in the centre of the top. Here a tube of lead is fixed, which descends nearly to the bottom, and down through which the vertical axis passes, to whose lower end the cross-bars of iron, or of wood, sheathed with lead, are attached, by whose revolution the materials receive the proper agitation for mixing the dense manganese with the sulphuric acid and salt. The motion is communicated either by the hand of a workman applied from time to time to a winch at top, or it is given by connecting the axis with wheel work, impelled by a stream of water, or a steam engine. The third opening admits the syphon-formed funnel, through which the sulphuric acid is introduced; and the fourth is the orifice of the eduction pipe.

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* A mixture of lime, clay, and oxide of iron, separately calcined, and reduced to a fine powder. It must be kept in close vessels, and mixed with the requisite water when used.

Manufacturers differ much from each other in the proportion of their materials for generating chlorine. In general, 10 cwt. of salt are mixed with from 10 to 14 cwt. of manganese, to which mixture, after its introduction into the alembic, from 12 to 14 of sulphuric acid are added, in successive portions. That quantity of oil of vitriol must, however, be previously diluted with water, till its specific gravity becomes about 1.65. But, indeed, this dilution is seldom actually made, for the manufacturer of bleaching powder almost always prepares his own sulphuric acid for the purpose, and therefore carries its concentration no higher in the leaden boilers than the density of 1.65, which, from my table of sulphuric acid, indicates 1-4th of its weight of water; and therefore 1-3d more of such acid must be used.

The fourth aperture, I have said, admits the eduction pipe. This pipe is afterwards conveyed into a leaden chest, or cylinder, into which all the other eduction pipes also terminate. They are connected with it simply by water-lutes, having a hydrostatic pressure of 2 or 3 inches. In this general *diversorium* the chlorine is washed from adhering muriatic acid, by passing through a little water, in which each tube is immersed; and from this, the gas is led off by a pretty large leaden tube, into the *combination room*. It usually enters in the top of the ceiling, whence it diffuses its heavy gas equally around.

Four days are required, at the ordinary rate of working, for making good, marketable bleaching powder. A more rapid formation would merely endanger an elevation of temperature, productive of muriate of lime, at the expense of the bleaching quality. But skilful manufacturers use here an alternating process. They pile up, first of all, the wooden trays only in alternate shelves in each column. At the end of two days the distillation is intermitted, and the chamber is laid open. After two hours the workman enters, to introduce the alternate trays, covered with fresh hydrate of lime, and at the same time rakes up, thoroughly, the half-formed chloride in the others. The door is then secured, and the chamber, after being filled for two days more with chlorine, is again opened, to allow the first set of trays to be removed, and to be replaced by others containing fresh hydrate, as before. Thus the process is conducted in regular alternation; thus, to my knowledge, very superior bleaching powder is manufactured, and thus the chlorine may be suffered to enter in a pretty uniform stream. But for this judicious plan, as the hydrate advances in impregnation, its faculty of absorption becoming diminished, it would be requisite to diminish proportionately the evolution of chlorine, or to allow the excess to escape, to the great loss of the proprietor, and, what is of more consequence, to the great detriment of the health of the workmen.

The manufacturer generally reckons on obtaining from one ton of rock-salt, employed as above, a ton and a half of good bleaching powder. But the following analysis of the operation will show, that he ought to obtain two tons.

[TO BE CONTINUED.]

A descriptive Account of the several Processes which are usually pursued, in the Manufacture of the Article known in Commerce by the name of Tin-Plate. By SAMUEL PARKES, F. L. S., *&c. Abridged for the Boston Journal of Science, from a paper read before the Philosophical Society of Manchester.*

ENGLISH bar-iron of the finest quality, called tin-iron, and which is generally prepared with *charcoal* instead of mineral coke, and made with the greatest care, for this particular purpose, is first cut to the necessary length, and then rolled at the mill, by a process which is peculiar to this manufacture, into plates of the requisite thinness, and of such form as is suitable for the business. These plates are then cut by hand-shears, to the sizes suitable to the different markets. And as the shearer shears the plates, he piles them in heaps, occasionally putting one plate the cross way, to keep each box separate. Two hundred and twenty-five plates are called a box, but they are not put into boxes of wood in this stage of the operation. The iron plates now go into the hands of the *scaler*, who takes them from the shear-house, and bends each of them singly across the middle, into this form V, preparatory to their being cleaned for tinning, and for the conveniency of putting them into the scaling furnace, as will be more fully explained hereafter.

This furnace, or oven, is heated by *flame* thrown into it from a fire-place of a peculiar construction, and it is this flame that scales the plates, which are put into the oven in rows, and arranged three in each row, until the oven is full. It will be obvious, that if they lay flat on the floor of the oven, the flame could play only on one side of each plate, whereas, by being bent in the form already described, the flame can operate equally on both sides. It may here be remarked, that the form of all tin-plates, one sort excepted, is that of a parallelogram, and that if a piece of stiff paper, or pasteboard, 13¾ inches long, and 10 inches wide, be bent in the centre at an angle of about sixty degrees, and then put to stand on the two ends, we shall have the form of a plate No. 1. properly bent for the scaling oven.

The operation of *cleansing*, as it is called, and which is preparatory to the process of scaling, is commenced by steeping the plates, for the space of four or five minutes, in a mixture of muriatic acid and water, in the proportion of four pounds of acid to three gallons of water. This quantity of the diluted acid will generally be sufficient for eighteen hundred plates, or eight boxes of 225 plates each.

When the plates have been steeped for the time prescribed, they are taken out of the liquor, and placed upon the floor, three in a row, and then by means of an iron rod put under them, they are conveyed to a furnace heated red-hot, where they remain until the heat takes off the scale, the removal of which was the object in submitting them to that high temperature.

When this is effected, the plates are taken to a floor, where they are suffered to cool—they are then straightened, and beaten smooth upon a cast-iron block. The workman knows by the appearance of the plates during this operation, whether they have been well scaled—for if they have, that is, if the rust or oxide which was attached to the iron, has been properly removed, they will appear mottled with blue and white, something like marbled paper. The operation we have been describing is called *scaling*.

As it is impossible the plates can go through this process without being in some measure warped, or otherwise disfigured, they are now rolled a *second* time, between a pair of cast-iron rollers, properly hardened and finely polished. This operation makes both sides of the plates perfectly smooth, and imparts a sort of polish to their surfaces. These rollers, are each about seventeen inches long, and 12 or 13 inches in diameter—but I am inclined to think, that if the diameter was greater,* they would set the plates flatter, and do the work better in every respect.

The technical name of this apparatus is *rolls*, not *rollers*. All the rolls which are employed in rolling plates, either hot or cold, in this manufactory, are *hard* rolls—and there is as much difference between a pair of *hard* cast-iron rolls, and a pair of *soft rolls*, although they may both be run out of the same pot of metal, as there is between iron and steel. The workmen inform me that the difference is entirely occasioned by the manner of casting them—the soft rolls being cast in sand, whereas, the hard rolls are formed by pouring the metal into a thick cast-iron box—and that the metal, by coming in contact with the cold box, is sufficiently chilled to render the whole face of the roll entirely hard. The difference in the temper of these two kinds of rolls is so great, that when they are put into the lathe to be turned perfectly true, the turnings from the one will be ⅛th of an inch in thickness, whilst the turnings which come from the other are not larger than very fine needles. The temper of cast-iron, thus varying according to the nature of the mould into which it is poured, is a circumstance that appears to me to be deserving of attention, in the manufacture of a variety of other utensils employed in the arts.

These rollers are used without heat, but they are screwed down very close one upon the other, only leaving bare room for the plates to pass, that the utmost attainable degree of pressure may be given to them. This last operation is called COLD ROLLING.

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* Since the above was written, I have submitted the manuscript to a gentleman who is very largely engaged in the manufacture of tin-plates, and he tells me, that the cold rolls which are employed in his work, are 30 inches in diameter.

When the plates have undergone this process, they are put, one by one, into troughs filled with a liquid preparation called *the lies.*

This is merely water, in which bran has been steeped for nine or ten days, until it has acquired a sufficient acidity for the purpose. The design of putting the plates into the troughs, *singly*, is, that there may be more certainty of the liquor getting between them, and both the sides of every plate being soaked alike in the lies. In this liquor they remain for ten or twelve hours, standing on the edges, but they are turned, or inverted, once during the time. This operation is called *working* in the lies.

The next operation is that of steeping in a mixture of sulphuric acid and water, in proportions which vary according to the judgment of the workmen.

The trough in which this operation is conducted, is made with thick lead, and the interior is divided by partitions of lead. Each of these divisions is by the workmen called a *hole*, and each of them will contain about one box of plates. In the diluted sulphuric acid, which is in the different compartments of this vessel, the plates are agitated for about an hour, or until they have become perfectly bright, and entirely free from the black spots which are always upon them when they are first immersed in it.

Some nicety, however, is required in this operation, for if they remain too long in the acid, they will become stained, or blistered by it, as the workmen term it; but practice enables a careful operator to judge of the time when they ought to be removed. This, however, is one of the most difficult parts of the business, as few men like to work in it; though I understand, that a good pickler is highly valued by his employers, and obtains great wages. It is necessary to notify that this, and the former process with the acidulated water, are both hastened by giving to those menstrua an increase of temperature—and this is effected by means of heated flues which run under each trough. Little additional heat is necessary in summer, however, as 90° or 100° of Fahrenheit is a temperature sufficiently high for either of these operations.

When the plates come out of the pickle, they are put into pure water, and scoured in it with hemp and sand, to remove any remaining oxide, or rust of iron, that may be still attached to them, for wherever there is a particle of rust, or even *dust* upon them, there the tin will not fix; and they are then put into fresh water, to be there preserved for the process of tinning. The design of putting the plates into pure water, after they come out of the sours, is to prevent their becoming again oxidated—for it has been found that after these operations, they will acquire no rust, although they should be kept twelve months immersed in water.

It will be perceived that all these processes are nothing more than preparatory measures, for the operation which is to succeed, viz. that of TINNING.

For this purpose, an iron pot is nearly filled with a mixture of *block* and *grain* tin, in a melted state; and a quantity of tallow or grease, sufficient, when melted, to cover the fluid metal, to the thickness of four inches, is put to it. However, as some gentlemen may not be acquainted with the difference between *block* and *grain* tin, it may be remarked, before we proceed, that the metal known in commerce by the name of block tin, is prepared either from the mineral called *tin-stone*, or the one known in Cornwall by the name of *tin-pyrites;* whilst the article called *grain-tin* is smelted from an ore which is found in grains called *stream tin* ore, under beds of alluvial soil, in low situations, whither, in the course of ages, it has been washed from the hills by a succession of torrents of rain. The former, which is produced in the greatest abundance, is always contaminated with a portion of iron, sulphur, and other injurious substances, and is, therefore, only employed for common purposes—while the grain tin, which is nearly free from every impurity, and usually from twenty to thirty shillings per hundred weight dearer, is used in the processes of dying, and in all other cases where *pure* tin is required. I am also desirous of remarking, that, in my opinion, it would be more profitable to the proprietor of a tin-plate work, if he were to use *grain* tin alone, or grain tin mixed with that kind which is known by the name of "Refined Tin," because these kinds not only contain less dross, but they melt, as I know by my own experience, into a more fluid metal; and consequently, more would run off the plates in the operation of tinning, and less tin would be consumed. At present, these manufacturers use the block and grain tin, in equal proportions.

When the tin-pot has been charged in the way above mentioned, the metal is heated from a fire-place underneath it, and by flues which go round the pot, until it is as hot as it can be made without actually inflaming the grease which swims upon its surface. The use of the grease is to preserve the tin from the action of the atmosphere, and consequently to prevent it from oxidating. By melting a little tin or lead in an iron ladle, and, when the dross is skimmed off, putting a morsel of tallow upon the metallic fluid, the effect of the tallow in cleansing the face of the metal will be evident. The workmen also say, that it increases the affinity of the iron for the tin, or, as they express it, that it makes the iron plates take the tin better.

It is curious that *burnt grease*, or any kind of empyreumatic fat, effects this purpose better than pure, fresh tallow.

Another pot, which is fixed by the side of the tin-pot, is filled with grease only; and in this the prepared plates are immersed, one by one, before they are treated with the tin; and when the pot is filled with them, they are suffered to remain in it so long as the superintendent thinks necessary. If they remain in the grease an hour, they are found to tin better than when a shorter time is allowed them.

From this pot they are removed, with the grease still adhering to them, into the pot just before spoken of, which contains the body of melted tin; and in this, they are placed in a vertical position. Three hundred and thirty-eight, or three hundred and forty plates are usually put into this pot at once; and, for the sake of their being thoroughly tinned, they usually remain in it one hour and a half; but occasionally, more time is required to complete this operation.

When the plates have lain a sufficient time immersed in the melted tin, they are taken out and placed upon an iron grating, that the superfluous metal may drain from them; but, notwithstanding this precaution, when they become cold there is always more metal found adhering to them than is necessary; and this is taken off by a subsequent process, called *washing*. As this process is rather complicated, it will be necessary to describe it with some minuteness.

[TO BE CONTINUED.]

Account of the Island of Ceylon, its Agriculture, and the Processes followed in several arts by the Natives.

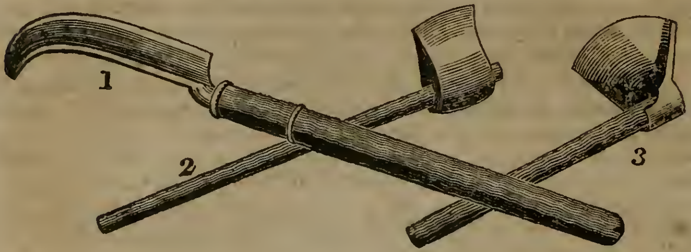
In the year 1809, the government of England, with a view of introducing British capital, machinery, British industry, and skill, into the ISLAND OF CEYLON, authorized, on the suggestion of Sir Alexander Johnston, (then president of the king's council in Ceylon,) the Ceylon government to annul, entirely, the restrictions which had theretofore been adopted against allowing any English, or other Europeans, to possess lands in the island of Ceylon, and to give every encouragement to Europeans to take grants of land in Ceylon. Since this period, Dr. Davy has published an interesting history of the Island, with much information respecting its agriculture. From this work, principally, the following account is extracted.

Agriculture is in no part of the world more respected or more followed, than in the interior of Ceylon. In common with all other arts, it is marked with great simplicity.

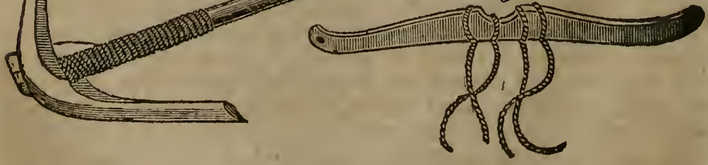
Most of the operations in the cultivation of paddy, (rice,) which is carried on wherever water for irrigation can be procured, are connected with, or have some relation to, the element on which its success depends. The farmer commences with repairing the banks of the paddy-field. He then admits water in sufficient quantity, to be an inch or two deep over the whole surface. After the ground has been well macerated and softened, he ploughs it, still under water. After further maceration, it is ploughed again, or merely trampled over by the buffaloes, till reduced to the state of mud: its surface is now levelled and smoothed. The water is drawn off, and the paddy, having been previously steeped in water until it has begun to germinate, is sown with the hand, and is scattered as equally as possible over the moist surface of mud. When the seed has taken root, and before the mud has had time to dry, the openings through which the water was drawn off are closed, and the field is again inundated. When the paddy is two or three inches high, it is weeded; and where the seed has failed, the vacant spots are planted from those parts which are too thick, and require thinning. The irrigation is continued, till the paddy is nearly full grown, and about to ripen, when openings are made in the banks, and the field is drained. As soon as ripe, the paddy is cut with reaping hooks, and immediately carried to the threshing-floor, where the grain is trampled out by buffaloes. From the moment the seed is sown, to the period of harvest, the paddy-field, like the chenas, requires constant night watching, to protect it from the depredations of its wild enemies. In the low countries, where the cultivation of paddy is in a great measure dependant on the rainy season, and on artificial reservoirs, for a farther supply of water, only one crop is procured annually; but amongst the mountains, in situations where perpetual irrigation is at command, the seasons are less concerned: the farmer can sow when he pleases, and from good ground annually obtain two, and it is said even three crops. One crop a year of the best paddy, which requires seven months, is, however, the most common: when two crops are procured, they are of an inferior grain, that comes to maturity in three or four months.

The hilly and mountainous districts, in consequence of being well supplied with water, are thus peculiarly favourable for the cultivation of this important grain; and it is a most fortunate circumstance that they are so; otherwise, the coolest, most salubrious, and most beautiful parts of the interior, would, instead of being cultivated to a certain extent, be quite neglected and deserted. In the low country, the paddy-fields are generally of a large size, and apparently quite flat; and every crop being in the same state of vegetation, or nearly so, the whole exhibits very little variety of surface. Amongst the mountains it is quite different; paddy-fields there, are a succession of terraces, or flights of steps; and in each field the crop may be in different stages of growth,—in some, just vegetating, in others full grown, ripening, or ripe; there, at the same time, you may see the labourers at all their different operations,—banking, ploughing, sowing, weeding, reaping, and treading out the grain. Dr. Davy observes that he does not know any scene more interesting, than a highland valley thus cultivated, or more beautiful, when (as it generally is,) it is surrounded by the bold, wild, and frequently savage scenery, of untamed nature. In the low lands, the labour and skill required to cultivate paddy, are less than are necessary in the high lands. In cutting terraces in the sides of the hills, the perseverance and industry of the mountaineer, are often in a striking manner displayed. Many of the beds are actually walled up, and many of them are not four feet wide, and though generally long, occasionally they are, from the nature of the ground, so short, as well as narrow, that one would not suppose they were worth the labour of keeping in repair, much less that of making. In bringing water to his fields, and insuring them a constant supply, the judgment and skill of the cultivator are most exercised. Sometimes it is conducted two or three miles along the side of a hill, and occasionally, it is even carried from one side of a mountain to another, by means of wooden pipes.

The implements of husbandry employed by the Singalese are few in number, of a very simple description, and resemble ours in many particulars. For cutting down trees, and clearing underwood, they have a *wal-dakat*, or jungle-hook, Fig. 1, and a *proa*, or axe, Fig. 2: their *udala*, Fig. 3, Dr. Davy states, (we think erroneously,) is for digging where the plough cannot be used, and for banking.



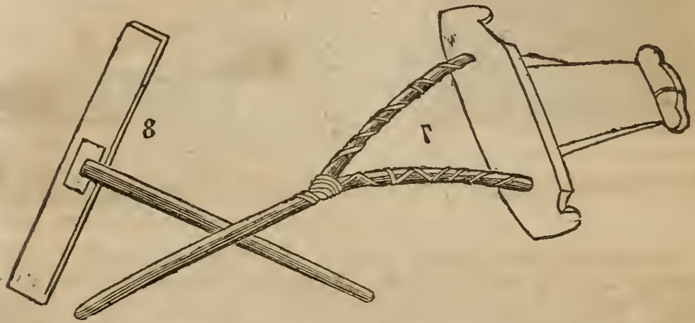
Similar instruments to these, but superior in their quality, may be procured of our own manufacturers. We do not remember to have seen any thing exactly like Fig. 1, ready made, but an excellent substitute will be found in the heavier kind of West India matchets, used for cutting down sugar canes. Fig. 2 is, decidedly, our common felling axe for trees, the only material variation being in the pole or thick part at the back, which in the Singalese is rounded or made convex, while ours is made flat in that part, and is used by the carpenters frequently in lieu of a heavy hammer. Fig. 3, is in all respects like some of our country axes; that peculiar manner of forming the eye for the handle is defective, and is only adopted as a readier and cheaper way of making the tool; the eyes in the best axes are always made the length of the pole, as in Fig. 2.



The Singalese plough, *naguela*, is of the simplest and lightest kind, as delineated at Fig. 4; and this plough is attached to a yoke, *viaga*, Fig. 5, and drawn by a pair of buffaloes, the husbandman holding the plough by one hand, while in the other he holds a goad, *kaweta*, Fig. 6, with which, and his voice, he directs and stimulates the animals.

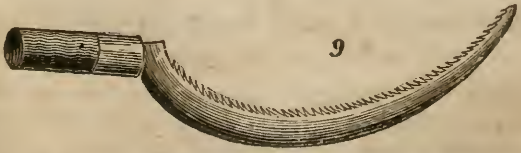
As a substitute for this miserable machine for tillage, it is gratifying and encouraging to learn, that the Scotch plough, drawn by elephants, has lately been introduced by some new settlers, with eminent success; its potent operation in accelerating the work, has, we understand, made it a great favourite with the natives.

For levelling the ground after ploughing, they use the *anadatpoorooa*, Fig. 7; which, like the plough, is drawn by a pair of buffaloes, the driver sitting on it, to give it momentum. For smoothing the surface of the mud, preparatory to sowing, the light hand instrument, the *atpoorooa*, or *goelalé*, Fig. 8, is employed.



For the *anadatpoorooa*, the repositories of our agricultural implement makers will afford many improved substitutes; a light harrow must surely be better adapted for levelling after the plough. The blade of the *atpoorooa* would of course be better of sheet-iron than of wood.

The reaping-hook, called by the Singalese *guygon-kopana-dakat*, Fig. 9, has a fine serrated edge. This reaping-hook is made rather clumsier than ours, but in other respects is the same: the manufacture of this article in England is superior in quality to that of all the world, and at an inferior price.



After reaping, the grain is trampled out from the straw by buffaloes, upon a floor made of beaten clay. For separating the chaff from the grain, they use the winnow, *coola*, delineated at Fig. 10, which is composed of strong matting and a frame of tough twigs. The husking is, of course, but very imperfectly done in this way;

accordingly, the Singalese use subsequently a pestle and mortar, for completing the operation of husking, preparatory to pounding it for food. These pestles and mortars, *wang-gadea*, represented by Figs. 11, 12, and 13, are generally made of wood, though sometimes of stone.

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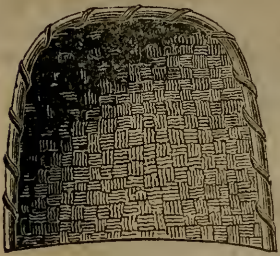

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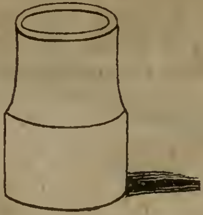

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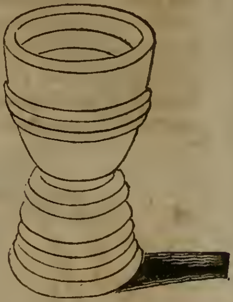

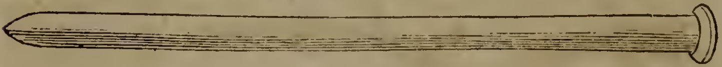

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For the *coola*, the common winnow, might advantageously be substituted, as it is almost equally simple, and would be more efficacious. Might not the new patent machine for husking rice, described in the present number, be introduced by the new settlers? A substitute for the inefficient apparatus employed by the Singalese, is highly important in the preparation of an article of universal and constant consumption.

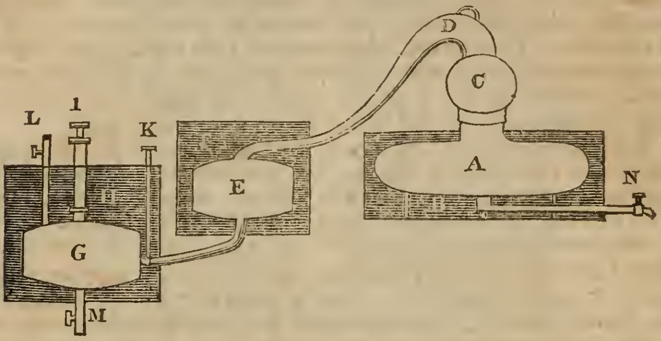
Instead of the *wang-gadeas*, our cast-iron pestles and mortars might be used with great advantage.

[TO BE CONTINUED.]

On Distillation in Vacuo, with a section of Tritton's *improved apparatus for that purpose.*

That celebrated philosopher and mechanic, the late Mr. Watt, having ascertained that liquids boiled in vacuo at a much lower temperature than when under the pressure of the atmosphere, ingeniously applied this fact to distillation. The discovery led Mr. Tritton to construct a distilling apparatus, which, from its simplicity and economy, is well deserving the attention of the public. The vessels are arranged in the manner of Woolfe's Apparatus, and the cucurbite, or body of the still, is immersed in a water bath, which renders it impossible to overheat or burn the matter contained therein, and therefore prevents an empyreumatic flavour from being communicated to the spirit. The following engraving will give an idea of the plan upon which it is constructed.

Section of an Improved Still, exhibiting the Principle of Mr. Tritton's Apparatus for Distilling in Vacuo.



A is the body of the still; B is a water bath, into which the body of the still is immersed; C is the head, or capital; D is the neck of the same, which, curving downwards, is connected with a pipe that enters the condensing vessel E; F is a refrigeratory, or close vessel, containing cold water, for converting into liquid the spirituous vapours, which, having been raised in the still, are contained in the vessel E. From the bottom of the vessel E, a pipe issues for conveying the liquid, and the vapour not yet condensed, into vessel G, which, being surrounded with cold water contained in the vessel H, acts also as a refrigeratory, and reduces the whole of the remaining vapour into a liquid state. I is an air pump, for effecting a vacuum in the vessels A E G. K is a stop-cock, for cutting off the communication between the vessels E and G, when the contents of G are drawn off by the cock M, by which means a vacuum is preserved, during that operation, in the vessel E, and the still A; L is an air-cock, to admit air into vessel G, to allow the contents to run out at M; N is a discharge-cock to the still A.

It is evident, that without a vacuum being produced, the matter contained in the still can never be heated beyond 212°, that being the greatest degree of heat that the surrounding liquid, water, is capable of receiving, or transmitting. But as this apparatus affords a convenient and easy mode of removing the pressure of the atmosphere, by means of an air pump, the distillation is effected at the low temperature of 132°, and the regular application of so low a degree of heat cannot fail to produce a spirit of the purest and strongest quality.

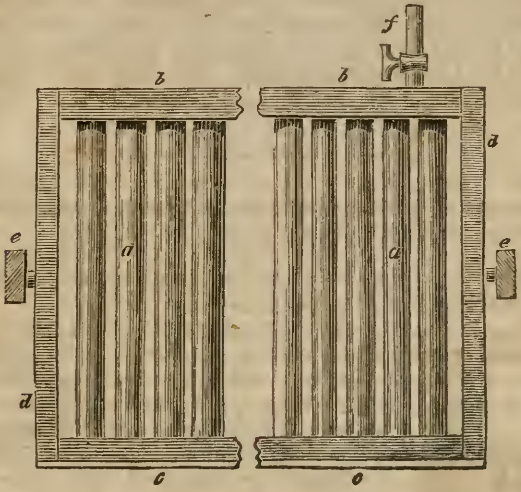
Observations on the use of Bladders in Rectifying Spirits, with a Description of an Apparatus intended to facilitate the Process. By L. Hebert, *Engineer.*

The rectification of spirits on the large scale, is usually effected by repeated and careful distillations, in stills of smaller magnitude than those first employed to separate them from the fermented wash. Thus is formed what is commonly termed *spirits of wine*, which still contains a portion of water, that cannot be wholly got rid of by redistillation. The chemist, therefore, who has occasion for absolute *alcohol*, makes use of some alkaline salt, (such as the carbonate of potass,) which, having a greater affinity for water than the alcohol has, combines with it, and leaves the alcohol nearly pure.

Instead, however, of mixing the alkaline salt with the spirit, as in the former case, another process has been adopted in France, which has been particularly described in a former number of this Journal. This process consists in placing a quantity of the dry muriate of lime, or other deliquescent salt, in a series of large, shallow, covered vessels, placed one over another; inside of each of these, is another shallow vessel of smaller dimensions. In the upper internal vessel, is placed the diluted spirit to be concentrated: the external vessels being perfectly closed and luted, they are left for a day, for the deliquescent salt to attract, and imbibe, the water from the spirit. The salt being saturated, a cock is opened, by which the spirit, considerably increased in its strength, descends into a similar vessel beneath, which is charged as the former, with the dry muriate of lime. The concentration of the spirit being here further increased, it is allowed to flow into a third, fourth, or fifth vessel, in a similar manner, the last of which raises the spirit to perfect alcohol. The operation is thus performed wholly in the *cold*, i. e. without the application of any artificial heat whatever.

The strongest alcohol may however be obtained, by another, yet rather dilatory, process, as it has hitherto been practised. It is, to put the spirits into bladders, and suspend them in a warm room, or over a heated sand bath. Now, as bladder is pervious to water, and impervious to alcohol, the former passes out, leaving only the latter remaining, in a highly concentrated state. In a few days the diluted spirit thus exposed, loses one fourth of its volume.

We have never made this experiment ourselves, but the fact being supported by the concurrent testimony of many respectable chemists, we have no doubt of its truth. On account of the little heat necessary to effect this rectification, we cannot help thinking that it may be made one of great economy, if an apparatus can be devised for conducting the process extensively, and with little labour. For this purpose we would suggest, that instead of the ordinary animal bladder, the æsophagus of oxen, (the buffalo, or the elephant, in India,) be employed, as exposing a larger surface to the air, and as being more convenient for adapting a series of them to a suitable framing, which we propose to be suspended upon pivots, in a heated apartment; or in warm climates, to the heat of the sun. The following diagram will explain what we will take leave to call (though not strictly correct) *a bladder rectifying apparatus.*



a a are the æsophagus bladders, distended between a framing *b b*, and *c c*, which is exhibited as broken away towards the middle, to denote that it may be made of any convenient width or length. The bars *d d* connect the upper and lower pieces, and carry the pivots or axles, which turn in the cross beams or supports *e e*, shown in section. The upper side of the frame *b b*, is intended to be formed of a square or round *tube*, in which are made circular apertures for the reception of the upper ends of the bladders, *a a*, which are to be kept open and distended by wooden rings, and properly secured by cement. The lower ends of the bladders pass through similar apertures in the bottom rail, where they are cemented, and kept closed up, and secured from injury by a board screwed over them into the rail *c c*.

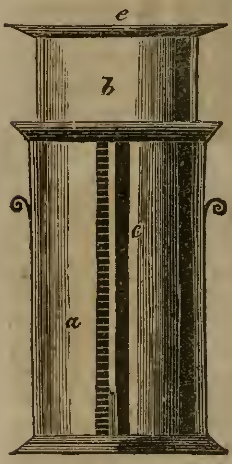
We will now suppose that fifty (or any other number) of such bladders, are fixed to a frame, and charged with diluted spirit, by means of a moveable hose and nozle, leading into the tube of the open cock *f*; that done, the cock *f* is to be closed. In the same manner, let all the other frames in the apartment or manufactory be charged, of which there may be any number. If 100 frames, there would be 2 or 3000 gallons suspended, which may then be submitted to a moderate heat, no matter whether that of the sun or a stove. A building on the plan of a green-house or hot-house, would answer for both purposes.

When it is found that the spirit has parted with its aqueous fluid, in any of the frames, they are to be turned half-way round on their pivots, by which the upper side *b b* becomes the under, and the cock being opened, the concentrated spirit may be discharged by means of a hose, into suitable recipients.

It is obvious, that by some such simple arrangement, the whole work of charging and discharging the apparatus of a very extensive manufactory, might be accomplished by a single individual, with very great facility, and without subjecting the bladders to any sensible wear for a considerable period. We shall leave others to improve upon the hints we have thus submitted.

Description of an Hydraulic Weighing Machine, invented by J. I. Hawkins, *Civil Engineer, London.*

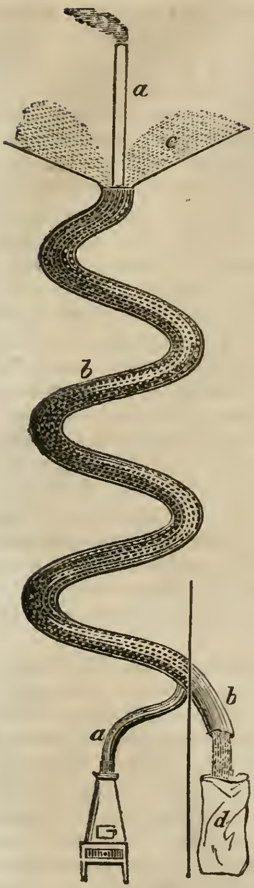
The following is a brief description of a very novel and simple weighing machine made by Mr. Hawkins.



a is a cylinder made of tin, and japanned, which is partly filled with water; *b* is another cylinder of rather less diameter, resting upon and floating in the water contained in *a*:—*c* is a graduated scale with a glass tube running up the middle, fixed to the exterior cylinder, *a*; the bottom of this glass tube opens into the lower part of the cylinder, therefore the water always stands at the same level in both; *e* is a dish or scale for holding the goods to be weighed, the pressure of which causes the internal cylinder to sink lower and raise the water higher in the same proportion, and the exact weight is indicated by the graduated line on the scale, which is upon a level with the surface of the column of water contained in the glass tube; precisely in the same manner as the temperature of the atmosphere is shown by the mercury in the tube of a thermometer. It appears upon the whole that this singular and elegant contrivance is well calculated to weigh accurately, which may at any time easily be proved by placing a given weight into the scale.

Description of an Apparatus for Speedily Drying Damp or Mildewed Corn, invented by L. Hebert, *Engineer, London.*

It is, I believe, a well ascertained fact, that grain may be kept uninjured for an indefinite period of time, if air and moisture be carefully excluded. If any thing were wanting to prove this, the extraordinary experiment made with the Indian corn found in the graves of the ancient Peruvians, (buried more than 300 years ago) which,



when sown, vegetated, and came to maturity, is sufficient proof of the fact to set all doubts at rest. To preserve grain, however, for only two, three, or four years, with its nutritious properties unimpaired, is all that a nation can require; as the produce of the seasons of dearth and of scarcity might then be equalized, and *bread be maintained at a low and regular price.* This the tillers of the soil and the working part of the public generally, have an undoubted right to expect from the owners of the land, in return for their labour in producing every thing for them.

It not unfrequently happens, during a wet harvest season, that the corn is necessarily carried from the field in a damp state; and as but few farmers have the means of properly and speedily drying it, large quantities are irrecoverably spoiled, after all the labour and expense of the production. The method of drying on the perforated tiled floor of a kiln is usually resorted to, *where it can be obtained;* but it is a very tedious, defective, and expensive mode; besides being attended with great labour, owing to the necessity of its having continually to be turned over and spread about by a workman, whose utmost care is insufficient to cause every part to receive an equal degree of heat.

To procure the adoption of any new apparatus for the purpose of drying corn, it is necessary that it should be of simple construction, of small cost, and occasion but little labour in its use; I have therefore thought that something of the following kind might be rendered generally eligible for the purpose, as it admits of either a large or small quantity of grain being dried at a very trifling expense, and the apparatus may be made of any size to suit the magnitude of the farm where it might be erected. The apparatus is likewise nearly self-acting, requiring scarcely any labour or attention.

I propose to have a cast iron pyramidical stove *a* in the lower part of a granary, warehouse, or barn, with a spiral tube of cast iron (something like a distiller's worm) fitted to the top of the stove, and reaching to above the roof of the building, for conveying off the smoke. I prefer cast iron for this purpose to wrought or sheet iron, on account of its greater durability, which will render repairs unnecessary for a long series of years; wrought iron stove pipes soon wear out, are usually fitted very inaccurately at the joints, and are exceedingly troublesome. I would have the mould for my cast iron tubing made light, and have them all cast alike from one mould, in pieces about three feet long; excepting the top and bottom piece, which would necessarily vary from the others. The joints should be made by a circular rebate at each end, so accommodated that the upper end of one piece would fit accurately into the lower end of another, and so on throughout the whole length of the spiral chimney; and every joint, on putting them together, should be properly luted, to prevent the possibility of smoke escaping, which might be easily done. If an objection should be made to the weight of such a tubing, it might be easily supported (if necessary) in various obvious ways.

The grain I suppose to be deposited in the top floor of the building, or rather in one corner of the same; and it appears to me as a desirable plan, if the building should consist of several floors, that a square piece of equal area in each floor should be cut away; and that such portion should be left open from one to the other, and partitioned off from the rooms, in the same manner as a stair-case; by which means the heat radiating from the stove or tube, would be longer confined in that situation where it would be most required. If only the corner of the building were thus appropriated, it would be no inconvenience to place the grain on a small flooring of inclined planes, in the manner of a hopper, as shown at *c*. The grain would then readily run down between the interior and exterior tubes (which I shall presently describe) without the necessity of the intervention of any manual labour.

b b is another spiral tube to be made of wrought iron, and of larger dimensions than that of the cast iron chimney which it encloses. This exterior tube is to be punched (*from the outside to the inside*) with holes, but not so large as to allow a grain of corn passing through, and as numerous and as close to one another as possible. The configuration of this exterior tube should, of course, be precisely similar to the other, so as to be kept uniformly, throughout its serpentine course, at the same distance apart from it; which I propose to be about an inch and a half. The rough projections in the inside of the exterior tube, are of important service in giving a rolling motion to every individual grain, so that being spread over a very extended surface in a thin stratum, and every grain being put in motion, the heat would be communicated over every part, and the resulting vapour rapidly extricated, by its freely passing off through the perforations. The length of the passage between the tubes may be from 40 to 100 feet, according to the size of the apparatus (the longer of course the better;) and when it comes within four or five feet of the stove, I propose that the course of the exterior tube be turned from the stove pipe (which might be so much heated near the stove, as to injure the vegetative property of the grain, should it be required for sowing) and that it may pass from thence through the partition beforementioned, into some receptacle or receptacles, capable of being closed air-tight. As these receptacles should also be proof against the attacks of rats, mice, and other vermin, it is probable that the employment of metallic casings, made either of thin sheet iron, or lead, would be most desirable. If the vermin could be altogether kept out of the granary, by some of the usual precautions, then the preserving of the grain from the air only might be an object easily and cheaply obtained. What strikes me as one of the most desirable substances to be employed for this purpose, is the new patent material in imitation of leather, recently invented by Mr. Thomas Hancock, which consists of a fibrous felted cloth, saturated with liquid elastic gum or caoutchouc. This fabric must be entirely impervious to air and moisture, and extremely pliable; I therefore think if it were made into bags for receiving the dried corn, the latter might be preserved in a perfect state for a long series of years.

I intend, however, to be understood as only submitting what I consider to be a mode of drying corn thoroughly, rapidly, and almost without trouble, preferable to those now in use, and leaving such subsequent mode of preservation to be adopted, as circumstances or situation might render eligible.

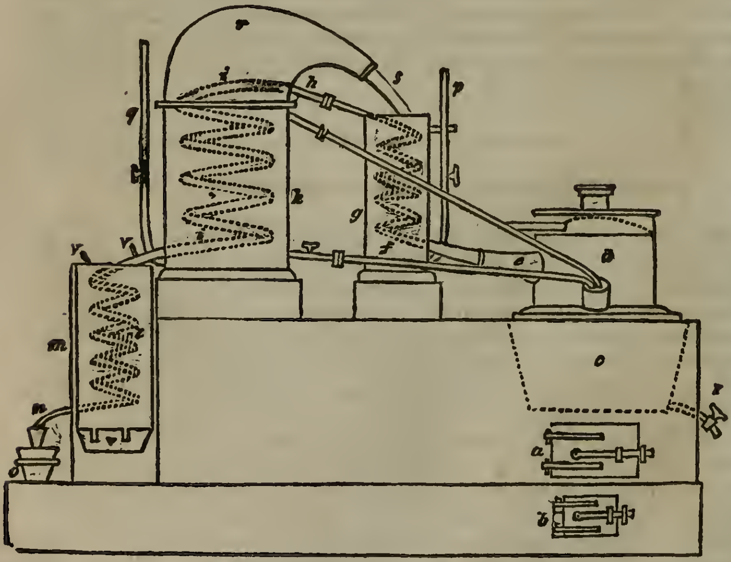
Instead of punched sheet-iron for the exterior tube, wire-work might be substituted, and the distance between the exterior and interior tubes (in either case) be preserved by means of stout cross-wires. These cross wires would offer a desirable impediment to the too rapid descent of the corn, which may, however, be regulated by merely enlarging or contracting the aperture by which the corn makes its exit.

Description of SALIMAN'S *Still, as improved by* CURADAU.

WE have given several improved English and French stills, in our previous numbers, and have promised to resume this subject. In England, an oppressive and vexatious excise law, interferes with the progress of improvement in the business of distillation; and the consequence has been, that the French have excelled them in this art; that is, in the economy of the operations pursued. We now present to our readers, two of the improved French stills. The following is by Saliman and Curadau.

a is the door of the furnace, *b* the ash hole, *c* the boiler, with its large cylindrical head *d; e* the exit tube for the vapours, connected by a union joint to the worm *f*. in the tub *g*. This tub is kept filled with water, at a temperature of about 180° Faht., and the spirituous vapour that passes upward through the worm *f*, along the tube *h*, then descends through the worm *i i*, surrounded with wine in the vessel *k*, where it becomes condensed; the liquid spirit, then runs through another worm *l*, surrounded with cold water, which completely cools it, before it is discharged by the pipe *n* into the recipient *o*.

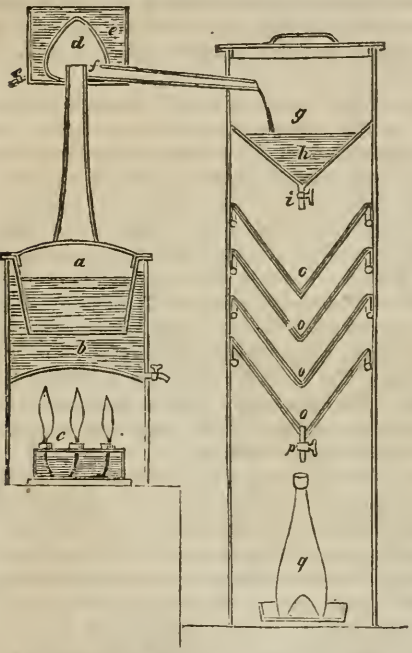
To prevent the water from becoming too hot in the tub *g*, by the passage of the heated vapour through the worm *f*, and to preserve it at an even temperature, cold water, from an elevated cistern, is introduced at the bottom, by a pipe *p*, the quantity being regulated by a stop-cock; and the wine which surrounds the worm *i i*, in the tub *k*, is supplied from a vessel above, by means of the pipe *q*. This wine, in the course of distillation, grows hot, it is therefore used to charge the still, as often as the former charge is worked off, and the spirits drawn off by the cock *t;* and as it is economical to take off the hottest portion, the cock in *q* is opened, when the cold wine from the cistern above enters at the bottom of *k*, and forces the upper, or heated portion, along the pipe *u*, into the boiler of the still. The spirituous vapours formed in the tub *k*, are conducted by the head *r*, and the curved neck *s*, into the worm *f*, where it takes the course of the vapours which proceed from the still. The tub *m* is kept as cold as possible, by an ingenious contrivance of Mr. Curadau's. A number of spiral pipes surround the tub on the inside, the ends of only two of which are shown in the figure, to avoid confusion. Now as the upper part of the tub is always the warmest, a current of air is produced in these pipes, which serves to cool the water in which they are placed.



The worm *f*, being surrounded with a medium at so high a temperature as 180°, only allows of the alcoholic portion of the vapour to ascend through it, the aqueous part running back into the still; so that spirits may, by this apparatus, be obtained of great strength by a single operation.

Description of the Liqueur Still used in Paris, for the purpose of Distilling Liqueurs for the Table.

a Is the boiler (containing the diluted spirits and flavouring spices,) immersed in a water bath *b*, and heated by a spirit lamp *c*, having several wicks. The still has a tall neck, surmounted by a head *d*, which is surrounded by cold water, forming the refrigeratory.



The vapour, as it is condensed, runs down the sides of the head in a liquid form, and is received in a circular channel, formed around the upper extremity of the neck: from thence it flows along a pipe through the cold water cistern, into a recipient *g*, fixed above a series of funnel shaped filterers. Previous to commencing the process of distillation, the recipient *g* is provided with a sufficient quantity of sirop (solution of white sugar,) to form the intended liqueur, over which the condensed spirit discharges itself. When all the spirit is come over, the distillation is stopped by extinguishing the lamp; the cock *i* is now opened, when the aromatic spirit and the sirop descend into the first of the filterers *o o o o*. These filterers are each composed of four distinct substances or layers; the lowest is of perforated metal, the next above, fine flannel, over which is put two thicknesses of filtering paper. The spirit and the sirop become intimately blended in passing through these successive filterers, and are received into bottles beneath in a perfectly bright and clear state.

ESSAYS ON LITHOGRAPHY.—No. VII.

Imitation of Aqua-tinta.

A NUMBER of methods have been devised to produce lithographic imitations of engravings in *aqua-tinta*, which bear a strong resemblance to those drawings produced by washing with India ink. Lithography, however, does not seem to admit of very perfect imitations of this kind, as many difficulties present themselves in the way of their accomplishment. The dark spots upon the stone, which produce the different shades upon the picture, must be extremely close to each other, and from the pressure necessary in taking the impressions, they are liable to spread sufficiently to become confounded together, and consequently to destroy the distinctness, and spoil the whole effect, of the drawing. We, nevertheless, think it best, for the satisfaction of our readers, to say a few words upon this subject. The Germans have tried various processes, but they have been generally given up; nor have the attempts of the French proved more successful.

We shall first describe a method which strongly resembles that followed upon copper, but in this case, pulverized gum-arabic, is employed instead of a resinous substance; the gum is rapidly sifted over the face of the polished stone, the grains being more or less fine, according to the size of the spots which it is wished to produce. This gum is affixed by a slight moistening of the stone; care being taken that it is only sufficiently humid to retain the particles of gum, without dissolving them. When the stone has become dry, that portion which does not adhere, is carefully removed; linseed oil is now to be applied to the stone, which will be imbibed by it whereever there is an interstice, or spot, not covered by the gum; the excess of oil which remains upon the surface, must be removed by blotting paper, or a soft rag. The stone may now be moistened to dissolve the gum, which must be washed off; it may then be prepared, and inked, and impressions taken from it.

A second method consists in dabbing with lithographic ink, upon a stone which has been grained; being governed in so doing by the lightness, or depth, of the shades which are wanted. To accomplish this, patterns are cut in paper, to defend those parts which are to remain white, or to preserve in others, the degree of shade which has been given to them. The same end is sometimes obtained by coatings of coloured gum-water, put upon those parts which are not to receive the ink, or which have already received the necessary quantity. Before performing this operation, the design must be traced upon the stone, or the harmony and effect of the piece cannot be preserved. Those portions which have been sufficiently charged with the ink, being covered either with the paper patterns, or with gum-water, a larger quantity may be laid upon the others; observing always, that both the ink and the gum-water, must be allowed to dry between each operation. The ink used, is mixed with water, or with spirits of turpentine, to the consistence of common printing ink; and by applying this by means of a small cushion, or dabber, the tone of shading may be graduated from any degree of lightness, to the greatest depth. After having removed the gum, washed the stone thoroughly, and allowed it to dry, the other parts of the design are finished up, either with the crayon, or the brush; the scraper is used to lighten those portions which may be too deeply shaded, and to take away any spots which it is necessary to remove. This process requires considerable address, as it will not succeed without a minute attention to points which may appear trifling. A brush slightly charged with ink, is sometimes used instead of the dabber: the particles of ink are sprinkled on by passing the blade of a knife, or some similar article, over the points of the hairs.

Another method, which, although it has not been followed, might probably answer well, would be to draw the shadows with crayons upon a grained stone, and afterwards to blend them, by rubbing them with a stump formed of cork, using the crayons again wherever it is necessary, and again blending with the cork; the rubbing, in this case, should be with the side, and not with the point of the stump. The imitation of India ink drawings might be successfully essayed in this way.

On the combination of different Lithographic processes, in the execution of the same design.

When an artist has habituated himself to the different methods of drawing upon stone, so as to have acquired a correct judgment of their respective merits, and of the effects which they produce, he may then combine them together, and give to his compositions a degree of perfection, which could not be obtained from either singly. The masses, for example, may be executed with crayons, or in the aquatinta manner; the skies, and the details in architecture, by the mode of imitating ordinary engravings upon copper; the camel's-hair pencil, or the method for imitating wood cuts, to characterize the more delicate parts, to give the necessary relief, or to graduate the shades, in different plans and designs. Practice and good taste, are the best guides in these particulars.

When great softness and harmony are desired, the designs are sometimes printed upon a light gray chinese paper; otherwise a second stone is used, which is rubbed with oil upon all those parts which correspond with the ground of the drawing. The proper tint is given to this ground, by a roller charged with the varnish, without any lamp-black; upon this the impressions are placed, and passed again through the press; particular care being taken, that the lines surrounding the design, correspond exactly with those formed upon the second stone. The effect of a strong light is produced by cutting the stone, so that the rollers in passing over it, may not touch those parts where these lights are wanted.

On Tracing pieces of Music upon Stone.

Notwithstanding lithography offers many advantages over the method usually pursued in engraving and printing music, it has been almost totally neglected in France. There is a town in Germany, where from twelve to fifteen presses are constantly employed on this kind of work; and it is only necessary for our artists to habituate themselves to it, to execute it with great economy.

The *autographic* method may be pursued for obtaining impressions of pieces of music; this process has been already explained, and consists in writing the music upon autographic paper, and transferring it on to the stone, with the necessary precautions. The music, however, may be written directly upon the stone; but this requires more time, and is more difficult to execute than the former, as it must be written backwards. This difficulty may be removed by practice, which will soon render the process extremely easy. The first operation is to mark upon the stone with a crayon, the position of the lines, and the spaces between them, with such other particulars as may be wanted. The five lines which form each division are traced at once, by a proper instrument charged with ink. When these are completed, the cliffs, the bars, and other signs or marks, are drawn with a metallic pen; the heads of those notes which are to be black, are formed by a piece of brass wire, with a face of the proper size, covered with fine lines; this is dipped into the ink, and applied lightly to the stone; the heads of those notes which are to be white, are formed with the pen, as are also the tails of the notes, and the lines by which they are united. The stone is prepared, and the impression taken, in the same way as in other kinds of drawings or writings.

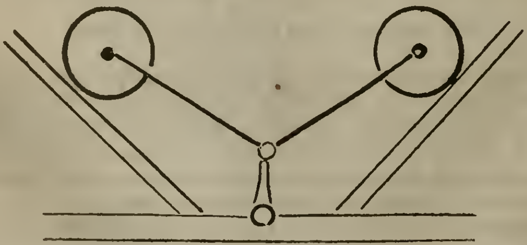
Observations on the supposed Loss of Power, in the alternate motion of heavy weights. *By* JOHN W. BAKEWELL, ESQ.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR,—I have the pleasure of enclosing some observations on the supposed loss of power, by an alternate motion of heavy weights, which, I hope, may be thought of some interest by the readers of the Franklin Journal.

The gentleman who will hand you this letter, will be able to give some description of a model which I have had made, to exemplify the position endeavoured to be sustained.

The model was made by engineers, who, in following the ideas induced by their profession, have added so much strength, and consequently friction, that it very imperfectly shows, what it was intended to do. It consists of a shaft, turning in a horizontal position, with a crank at each end, in opposite directions; to each of these cranks are attached, (by small connecting rods,) two brass weights, or wheels, which move, or roll, up and down inclined planes, at right angles to each other, thus:—



The means of attaching a fly wheel to the shaft, or detaching it at pleasure, were also provided in this model. When the fly wheel is *detached*, and a weight at the end of a string wound round the shaft, the velocity of the falling weight, and consequently the times of the alternations of the four weights, gradually increases, as if a fly wheel, and it *only*, were attached to the shaft.

When the string (being fast to the shaft,) has unwound itself, by the falling of the weight, it will, to a certain distance, be wound up again, with the weight in the opposite direction, and to an equal extent, (allowing for the greater friction,) as if the quantity of matter composing these alternating weights, were a fly wheel on the shaft of such size, as should give to the matter an equal velocity in the same time.*

I am, sir, &c.

THOMAS W. BAKEWELL.

Cincinnati, Ohio, March 5th, 1828.

In all propositions advanced, which contravene the generally received opinions in dynamics, the chance of their being correct is very small. And although I have frequently found myself, passing a precipitate judgment on the ideas of others, merely, because they were not "orthodox," yet, I am sometimes guilty of a like heresy.

In the present instance, my dissention from canonical faith, has reference to the supposed loss of power in the steam engine, and other mechanical agents, where an alternate motion is unavoidably given to a considerable mass of matter.

In works which treat of the steam engine, this point is generally brought forward, when comparing the respective merits and defects, of the usual alternating engine connected with a crank, and the rotatory engine. The advantages of greater facility in *making*, and the fewer practical objections in *using*, the former, are represented to be much detracted from, by the loss of power consequent on bringing a heavy lever beam, or other weight, alternately, from a state of rest, to motion, and from motion, to rest. I shall endeavour to show, that there is no loss of power in the alternate motion of a heavy weight, when connected with a crank.

As the point in discussion relates solely to the inertia of matter,—the putting in, and out of motion,—I shall, to simplify the case, in the subjoined diagram, represent the weight, or matter, as moving horizontally.

Let *a*, *b*, *d*, represent a semi-circle described by the pin of a crank, having an equable motion around the centre *c*, the power applied in the direction from *a* to *d*, in parallel lines, throughout the semi-circle, and the weight, whose inertia is to be overcome, moving also in the same parallel manner and direction. Let the dotted lines or radii represent the situation of the crank at the different points in its path.

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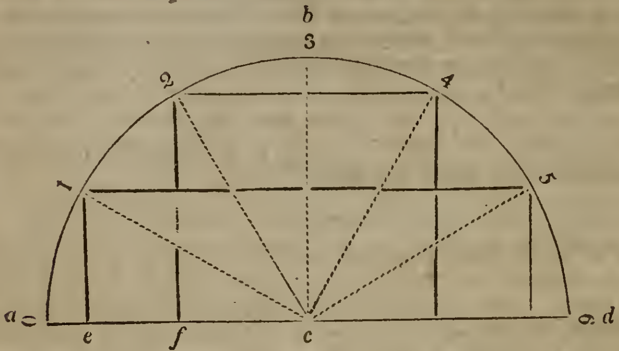
* It has been thought best to publish this letter, although it was merely intended for the Editor; but the information it contains, is so intimately connected with the essay which it enclosed, as to justify its insertion.

Let the points on the line *c*, *b*, where the chords 1, 5—2, 4, intersect said line, be the true length of the leverage of the crank, from the centre, when the crank-pin is at the several points in the circle, 1, 2, 4, 5, respectively.

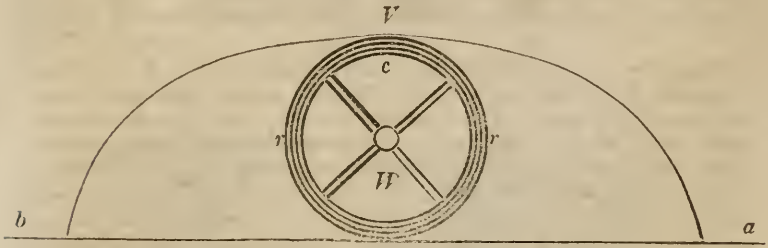


Let the lines, (ordinates,) *e*, *f*, *c*, at the points where they touch the line *a*, *d*, represent the distances passed over by the weight, during the corresponding spaces passed by the crank-pin in the arc, 1, 2, 3.

Now it is evident, while the crank-pin shall have moved in the circle from 0 to 3, it will have been retarded by bringing the weight from a state of rest corresponding with 0, to the motion acquired at 3, where the weight and crank-pin are at the greatest velocity; and it is equally evident, that the retardation by the weight connected to the crank-pin, while passing from 2 to 3, will, by the momentum acquired at 3, give an equal acceleration to it, in passing from 3 to 4. And that the sum of retardation to the crank, in passing from 0 to 3, occasioned by the weight connected to the pin, produces an equal acceleration, while passing from 3 to 6, during the stoppage of the motion acquired at 3.

I only give half the circle described by the crank, because the other half, is but a repetition of the operation.

It is not essential to the principle here attempted to be established, that the connecting rod, (pitman,) attached to the crank, and through which the power is applied, should be infinitely long, or act in parallel lines. There is no loss of power in a connecting rod, however short it may be, (an absence of friction being always supposed,) the power, with a short pitman would be unequally divided in the circle described by the crank, and would be greatest on the half adjoining to *a* in the figure. I will give the following case, as analogous to the crank. We know, that as a wheel rolls along a plane, each point in its circumference describes in one revolution, the half of an ellipse, whose transverse axis, is the line formed by the plane, between the point where any given part of the wheel touched the plane, and its again touching the plane; *i. e.* this line along the plane, included between the two touching points, is the longer diameter of the ellipse, and is, to the conjugate axis, or shortest diameter, as twice the diameter of a circle is to its circumference.



Let *W* be a wheel rolling along a plane, from *a* to *b*, let the periphery, or rim, *r*, *r*. be of some heavy material; let us take a portion of said heavy rim as *c*, at the vertex of the wheel *V*, in which situation, (if the wheel be in motion,) it is under the greatest velocity, being double that of the centre, or axis. By rolling the wheel back to *a*, we should bring the portion of the rim *c*, to touch the plane at *a*, where it would be at rest, and by rolling it forward, we bring the portion *c*, also to the plane at *b*, where it is likewise at rest.

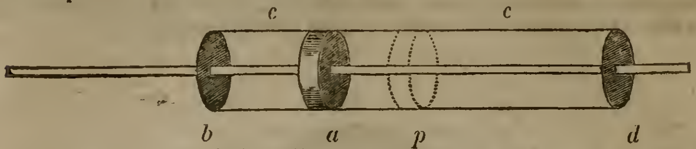
Here we see, that a heavy mass of matter is brought from a state of rest, at *a*, to any imaginable velocity at *V*, and again brought to perfect rest, at *b*.

The whole rim may be supposed to consist of like heavy portions of matter, which, although they balance each other, and produce an equable motion, yet, as regards the principle at issue, they may be considered in the same light when combined, as if taken separately.

Hence we perceive in this case, as in the crank, that the retardation of the wheel by the portion *c*, being brought from a state of rest at *a*, to the velocity, however great, at *V*, becomes an acceleration of equal value, in passing from *V* to *b*. If this were not the fact, the wheel would not continue to roll along the horizontal plane, until opposed by some force foreign to itself; even if it were without friction, or a resisting medium.

When the whole effect of an impulse given to a machine or engine, be resolved, or confined within itself, there can be no loss of power. When the effect, or any part thereof, be imparted to matter extrinsic to itself, there is loss of power to such engine or machine, although, strictly speaking, there can be no loss of power in nature.

If a body perfectly elastic, fall on a body perfectly hard, (unyielding,) or if the falling body be perfectly hard, and the object on which it impinge be perfectly elastic; or again, if the falling body and that on which it fall, both be perfectly elastic, the falling body will rise to the height from which it fell, and so continue to fall and rise. I premise the above on elastic bodies, to introduce an example of another species of alternate motion.



Suppose *c*, *c*, a cylinder filled with an elastic gas, or fluid, whose expansive force is in the inverse ratio of its volume; viz. when it occupies half the space, it is of double the force; and to make the case more plain, we will suppose this gas possessed of no inertia, or that it is capable of expansion or compression, to any change of volume, instantaneously, without any diminution of pressure, by the required quickness of its expansion, or offering more resistance, by the required quickness of its compression. Suppose an air-tight piston, fitted in said cylinder as at *p*, yet, capable of moving backwards and forwards in the cylinder, without friction, and, equal quantities of the elastic gas in the equal spaces on each side of the piston; then let some force move the piston to *a*, compressing the gas at the end *b*, to half its original volume, and the gas at the other end *d*, expanding in consequence of the space afforded, to one half more than its original volume, let the force be instantaneously removed from the piston: to what distance past the centre *p*, would it be driven?

I contend, that under the above circumstances, it would be driven to within the same distance of the end *d*, and the gas be compressed to the same density as it was at the end *b*; and it would thus continue *cæteris paribus*, to alternate for ever.

No alteration of weights or quantity of matter in the piston would effect the results, except varying the times of the alternations, so long as *velocity*, and quantity of matter, are equivalents to each other.

T. W. B.

Description of a New Steam Valve.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—Annexed is a section and front view of a steam valve that, so far as I am informed, is new; and with the partiality of an inventor, I am ready to fancy it an improvement, in some respects; at least for high pressure engines. Though similar in principle to the circular revolving valve, yet being reciprocating, it admits of the more neat movement of the concentric, and where it is desired to cut off steam, it may be effected by a cam giving a double motion.

Indeed, it appears to me that this plan combines the advantages both of the slide and the revolving valves, inasmuch as it shuts off steam close to the ends of the cylinder, and affords a large eduction passage, which may be extended to a jacket for the cylinder, with equal convenience; it will also be observed, that, while the pressure of steam is not so great as on the slide valve; at the entrance, and at the ports of the valve, it may be made to counterbalance, so that the common objection to slide valves for high pressure engines, is here obviated, while all the advantages are retained: to this may be added the facility of keeping all tight and in good repair, only requiring packing and a stuffing box round the neck at the centre, where there is least friction.

Fig. 1.

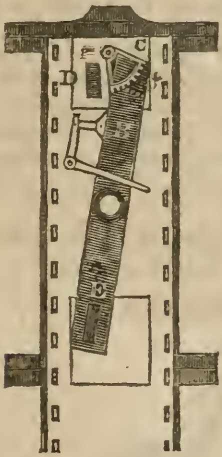


Fig. 2.

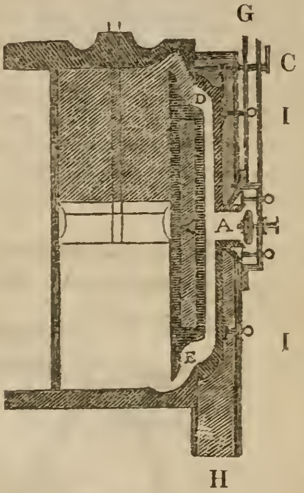


Fig. 1 is a front view, with the eduction chest off. A, the steam passage and centre of B, the valve, which is moved in the eduction chest by C, the segment with teeth, to open and shut D and E, the ports. The square dots on the sides represent flanches on the cylinder, nearly flush with the ports, to receive the eduction chest.

Fig. 2, is a section. A, neck of the valve B. C, segment. D and E, steam ports. G, induction. H, eduction. I I, screws to tighten valves.

In the section the *metal* is shaded, and the eduction is half shaded, to distinguish it from steam.

The conical valve at the neck of valve, is proposed to supply the place of the common throttle valve, regulating by a screw.

The valve would probably be better moved by a lever, instead of the segment, as at B, fig. 2, or by a rod (and link) passing directly through the side of the eduction chest.

Belidor.

Observations on the communication of power from a Water Wheel, with remarks upon an article on that subject, in the "LIBRARY OF USEFUL KNOWLEDGE."

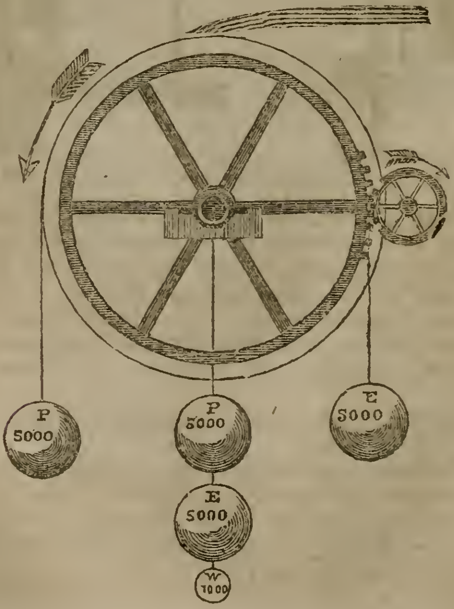
TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR,—In the 2nd Number of "Library of Useful Knowledge," article, Hydraulics, p. 28, I find the following passage.

"The power from a water wheel, ought likewise to be taken as nearly as possible at the point that is opposite to where the water is producing its greatest action on the wheel; otherwise a great, and in some cases, very unequal strain will be thrown upon different parts of its shafts and bearings, and such a one as, if it does not cause their fracture, will require unnecessary strength in them, and cannot fail to produce waste, and unequal wear, of the brasses or other bearings on which they are supported."

As I think the doctrine here inculcated essentially erroneous, I am sorry to see it in a publication so extensively useful as that in which it is contained; and in order that the error (if I prove it such) may be met by a correction in your valuable journal, I have endeavoured to illustrate the effects of the plan proposed, as contrasted with those of a different arrangement.

Fig. 1. *Method of Communicating Power from a Water Wheel, as proposed in the "Library of Useful Knowledge."*



In both the sketches of water-wheels, herewith sent, the power is taken from the segment wheel, at such distance from the centre as brings the pitch line co-incident with the centre of gravity of the bucket nearest to the pinion where the power is communicated; and this I have done rather to simplify the illustration, than because I deemed it the best circle on which to place the segment wheel.

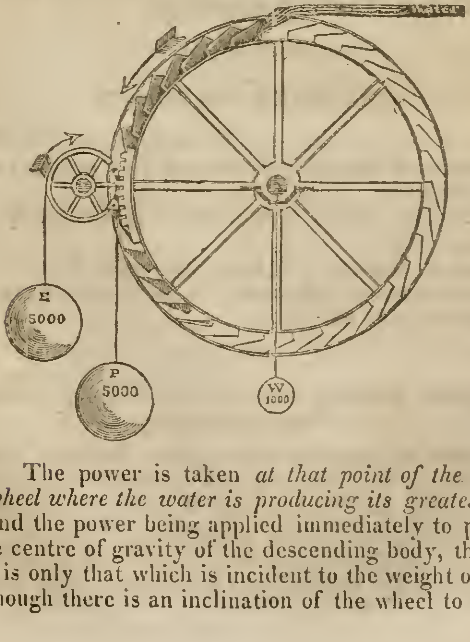
In Fig. 1, the power is taken (as recommended in the quotation above cited) from the segment wheel, "at a point that is *opposite* to where the water is producing its greatest action on the wheel." The power is hereby applied through the intervention of a lever formed by the arms of the water wheel, of which the journals in the centre, form the fulcrum.

I have assumed, for argument sake, that the power and effect are equal, although, strictly speaking, they are not exactly so. The stress on the journals will be the power, the effect, and the weight of the water wheel, added together: thus suppose

W, the weight of wheel, to be - -	1,000 lb.
P, the power, - - - - -	5,000
E, the effect, - - - - -	5,000

Then it appears clearly that the weight on the journals will be $W + P + E = 11,000$ lbs.

Fig. 2. *Proposed Method of Communicating Power from a Water Wheel.*



In Fig. 2. The power is taken *at that point of the descending side of the wheel where the water is producing its greatest action on the wheel:* and the power being applied immediately to produce the effect, at the centre of gravity of the descending body, the stress on the journals is only that which is incident to the weight of the water wheel; for though there is an inclination of the wheel to retire from the pinion, yet as that is the same in both the methods, it does not enter into the comparison.

As respects the stress on the arms in Fig. 1, as they form a lever resting on the journals at the centre as a fulcrum, they must sustain (in moving) the power, the effect, and the friction of the fulcrum; and inasmuch as friction is directly as the pressures, or nearly so, if the friction on the journals of Fig. 2 = 100 lb. the friction on the journals of Fig. 1, will equal 1100 lb.

In Fig. 2, on the other hand, the stress on the arms is only that which is incident to the friction of the journals.

The following, therefore, appear to be the comparative results:

	Fig. 1.	Fig. 2.
Stress on journals,	11,000 lb.	1,000 lb.
Stress on water-wheel arms,	11,000 lb.	Only sufficient to overcome friction of journals.
Friction on journals,	1,100	100

As respects the advantage proposed to be acquired in Fig. 1, of keeping the water wheel firm in its place; the weight of the wheel is always sufficient to answer that purpose, even should the power be communicated from the centre of gyration, as is evident from the remarks of the writer himself, when he speaks of the effects of resistance at the centre of gyration. But in the recommendation to take the power at the centre of gyration, the writer is, in my opinion, making an erroneous application of known principles, and, I propose, at a future time, to examine this point also. C.

FRANKLIN INSTITUTE.

PHILADELPHIA, APRIL 24, 1828.

THE Seventeenth Quarterly Meeting of the Franklin Institute, was held in the Hall.—

Henry Horn was called to the Chair, and George W. Smith was appointed Secretary.

The Board of Managers by their Chairman, Mr. S. J. Robbins, presented the Seventeenth Quarterly Report, which was read, accepted, and ordered to be published.

The Seventeenth Quarterly Report of the Board of Managers of the Franklin Institute.

The Board of Managers of the Franklin Institute, present to the General Meeting their Seventeenth Quarterly Report, by which it will be seen, that they have, within the last three months, adopted some measures of considerable importance, which, they confidently believe, will largely contribute to the successful prosecution of the objects for which the Institute was established. The Franklin Journal, which has hitherto been the sole property of the Professor of Mechanics, has, by an agreement entered into with Dr. Jones, been assumed by the Institute, whilst the Editorship is secured to him, during his life. The terms upon which this transfer has been made, are such as it is believed will tend to promote the interest of both the parties concerned, and is, therefore, likely to be lasting. Should this not prove to be the case, the Institute will, at the termination of the year, be at liberty to place the Journal on its former footing.

In a large Society, like the Franklin Institute, the duties of some of its offices are necessarily weighty, and although they may be performed with a degree of zeal which may entitle them to the approbation and gratitude of those whom they serve, it is yet unreasonable to expect that an individual, or a succession of individuals can be found, who will be willing, or able, to devote all that time and attention, gratuitously, which the best interests of the association demand. Fully convinced of the correctness of these remarks, the Board determined to employ an *Actuary*, who should keep his office at the Institute, and who should perform the active duties of the Treasurer, be the Secretary of the Board, and of the Standing Committees, have the care of the Hall, be the Librarian, and perform sundry other services, which it is not necessary here to enumerate. Such an officer had frequently been spoken of, but the labour to be performed did not require, nor would the remuneration which it was in our power to offer, obtain the services of a person possessing the requisite qualifications. On assuming the publication of the Journal, and issuing it from the Institute, these difficulties were removed, and such an office has been created.

It is with particular pleasure that the Board announces the appointment of Mr. William Hamilton as the Actuary, a gentleman well known, from his pursuits and character, to be eminently qualified for the station.

An event has just occurred, which will deprive the Institute of the direct services of Dr. Jones; as he has received, and accepted the appointment of Superintendent of the Patent office, under the government of the United States. This will enable him to add greatly to the value of the Journal, by the publication of the most important of those numerous patents which have, heretofore, been almost unknown to the world. Whilst this measure will diffuse a mass of valuable information, it will also promote the interests of many of our ingenious fellow citizens, whose labours are unappreciated, because they are unknown.

The board have much cause to regret, that the Institute will be deprived of the valuable services of Dr. Jones, as professor of mechanics, a station which he filled with great credit to himself, and advantage to the Institute. The appointment of a successor will claim the early attention of the Board.

Since the last Quarterly Report, a critical examination of the pupils of the high school has been held, a detailed report of which, and of the general progress, and merits of the establishment, has been published by the Committee of Instruction, which, it is unnecessary to inform you, accords a high degree of praise, both to the instructers and the pupils.

The Lectures for the season have now closed, and the Board have the satisfaction to state, that the orderly conduct of the youths, and the general attendance, and apparent interest excited in the classes, so favourably mentioned in the last report, have continued throughout; thus evincing, in a very striking manner, the utility of the regulations which had been adopted.

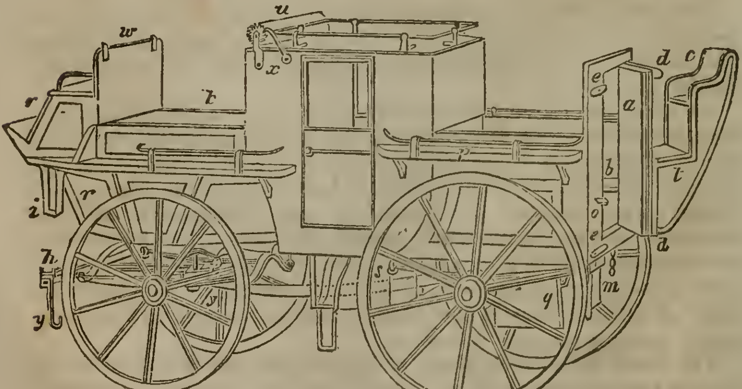
The professorship of Chemistry, rendered vacant by the resignation of Mr. Keating, has been filled by the appointment of Dr. Bache, a gentleman of undoubted attainments, and who has been performing the duties of the office for the last two years. All which is respectfully submitted, by

SAMUEL J. ROBBINS, *Chairman.*

Account of SKINNER'S *Improved Safe Coach.*

[From the Transactions of the Society of Arts.]

THE model produced before the committee of the Society of Arts, by Mr. Skinner, was considered by the coach-builders and axle-makers present, to combine, in a most ingenious and practical manner, the various improvements which for several years past have been proposed, and in part adopted, in the construction of stage coaches. So large a proportion of the travelling in this country is performed in these vehicles, that all proposals for improving them, by diminishing the labour upon the horses, and the liability of the passengers to accidents from the carriage overturning or breaking down, have been received with great attention by the society, and rewarded, if they offered even a probability of success. The lowering the centre of gravity, by removing the heavy luggage and outside passengers from the roof of the carriage; the convenient accommodation of the latter; the adop-



tion of high fore-wheels to ease the draught; and several minor conveniences, will be found to have been duly attended to, and to be combined in the model, of which the following is a description.

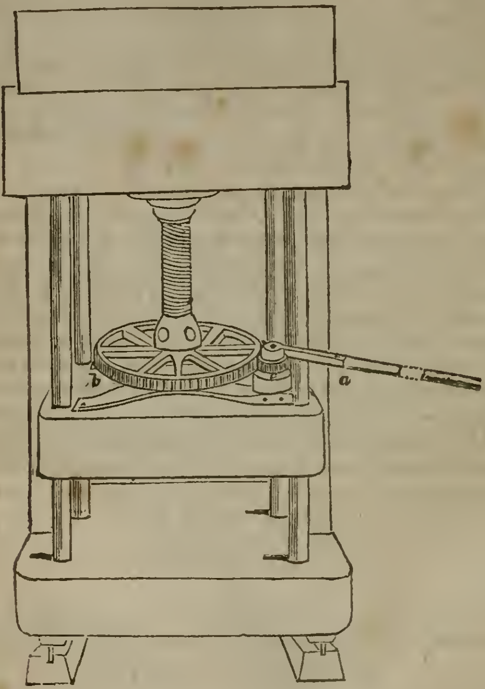
The preceding figure gives a perspective view of the vehicle. The front wheels are five feet nine inches in diameter. The inside and outside passengers are seated on the same level, the floor being as near to the axletrees, as the play of the springs will admit. *a*, the door through which the hind passengers get up, the seats being situated as shown at *b; c* is a seat for the guard, attached to the door *a; d d*, iron bars at the top and bottom of the door, projecting enough to be securely held by turn buckles *e e;* the steps *g*, *h*, and *i*, serve for the front passengers and the coachman to get up by; the passengers step upon the boards *j j* on either side, and over the side rails into the compartment *k;* the steps *l*, *m*, *n*, *o*, serve for ascending into the hinder part of the coach; *p p*, boards, (on each side) over the hind wheels; there are similar ones, *j j*, over the front wheels, which have iron rails to hold small luggage. To allow of locking the front wheels, the floor is narrowed in the manner delineated; *q* is the hind boot; *r r*, the front boot; *s*, boxes opening in the floor of the coach; *t* and *v*, boxes opening in the guard's seat; *u*, a roll of leather, to cover the front passengers; it has a slip of iron along its front, which catches on the hooks *w w;* it is wound up and held tight by a ratchet-wheel and latch *x;* the end of the axis is squared to put on a winder; *y*, the locking pin, which plays though the axletree: the locking plate is under the floor and above the springs; there are five springs in front, and five at the back, two across each axletree, and four across the coach answering to them, and two more, one over each axle-tree, and rubbing on them.

Description of the New Invented Wheel and Pinion Standing Press.

By Mr. I. L. Pouchee.

This improved press is calculated for many purposes besides those of bookbinders, stationers, and printers: for these trades, however, it is peculiarly adapted. We have not seen the press itself, our sketch being taken from a large engraving of it, just published by Mr. Pouchee; but of the advantages attending this arrangement of the component parts, there can be no question, and from its great simplicity, the expense must be very moderate: in power it may be made nearly equal to that of the hydrostatic press of Bramah: it occupies very little space, requires no *stays* either at the sides or the top, and can be worked with a small lever by one person, so as to produce an immense pressure.

There is but little in its structure that varies much from the ordinary press; the head, the bed, the cheeks, the screw, nut, &c. may be considered the same; the chief novelty consists in employing, in addition to these parts, a toothed wheel *b*, fixed on the axis of the screw, which is operated upon by the small pinion *c*, turned by the lever *a*, the latter being shifted on the axis at every fresh pull. The power of the press when brought down to the work, may thus be increased in proportion to the difference of the diameters between the large wheel and the little pinion: the slow operation of the press at this time is of little consequence. [*Register of Arts.*



AMERICAN PATENTS.

List of Patents granted in the United States, in January and February, 1828.

FOR INVENTIONS AND IMPROVEMENTS.

In gates for locks; Daniel Rodgers, of Little Falls Town, County of Herkimer, New York, January 4.

In the hydrostatic elevator; James M'Creary, of Noblestown, Alleghany County, Pennsylvania, January 5.

Improvement called a fluid agitator, or churning machine; Samuel

H. Baker, of Wells Township, Bradford County, Pennsylvania, January 10.

In manufacturing artificial stone; Robert M'Kay, Donald M'Kenzie, and Joseph Woodhull, Caledonia, Livingston County, New York, January 16.

In the tubular steam generator; Reid R. Throckmorton, New York, January 17.

In the machine for dressing flax and hemp; John C. Wenzel, of Louisville, Kentucky, January 17.

For sundry methods, by which inflammable gases may be generated during the combustion of anthracite coal; Minus Ward & Richard Wilmot Hall, of Baltimore, January 19.

In the common turning lathe; Jefferson Moore, of Leverett, Franklin County, Massachusetts, January 19.

In the vibrating machine for knapping cloth; Samuel Duncan, of Northampton, Montgomery County, New York, January 21.

In making water proof cloth, and water proof leather; J. L. Comstock, of Hartford, Connecticut, January 21.

In the floating excavator; Harvey W. Campbell, of Lockport, New York, January 22.

In the mode by which the yards of ships, or vessels, are suspended, topped, and braced; Samuel Adams Wells, of Boston, January 23.

In manufacturing barrels, hogsheads, &c.; William Adams and Marcus Adams; the former of Ogden, Monroe County, and the latter of East Bloomfield, Ontario County, New York, January 24.

In the machine for mortising; John J. Kelogg, of Richmond, Oswego County, New York, January 24.

In the spring saddle; Thomas Harvey, of Middletown, Delaware, January 24.

In the screw water wheel; Ebenezer Beard, of Charlestown, Massachusetts, January 25.

In the plough; William Wiard, of Avon, Livingston County, New York, January 26.

In the cooking stove; Robert C. Rouse, of Athens, Green County, New York, January 26.

In the construction of presses for hay, &c.; Moses B. Bliss, of Pittstown, Kennebeck County, Maine, January 26.

In the grist mill; William L. Taylor, of M'Minn County, Tennessee, January 28.

In making Brick; David Rising, of the Town of Colchester, Chittenden County, New York, January 29.

In the steam engine, Simeon Broadmeadow, New York, January, 29.

In the steam engine, William Willis, of Charleston, South Carolina, February 1.

In making an oil paint for painting plastered walls in houses; Alexander Thompson, of Betheney, Genessee County, New York, February 2.

For a medicine, entitled improved rheumatic pills; Ezra Deane, of Biddeford, Maine, February 2.

In the manufacture of combs; Uriah Bailey, of West Newbury, Essex County, Massachusetts, February 2.

For a medicine, entitled a remedy for dysentery, dyspepsia, jaundice, and all bilious complaints; Truman Powell, of Burlington, Chittenden County, Vermont, February 2.

In the machine for packing cotton; William J. Cocke, of Cabin Point, Sussex County, Virginia, February 4.

In the machine for distilling spirituous liquors, &c.; William J. Cocke, of do. do., February 4.

For an improvement in stoves, chimneys, furnaces, and steam engines; John James Giraud, of Baltimore, February 10.

In the excavator, or self-loading cart; Waldren Beach, of Philadelphia, February 5.

In the printing press; John C. Holbrook & Elihu H. Thomas, of Brattleborough, Vermont, February 7.

In the machine for junking ivory, by the aid of water, steam, &c.; Linus Pratt and Fenner Bush, of Meriden, New Haven County, Connecticut, February 9.

In making hubs, or naves for carriage wheels, called the Hercules hub; Hercules Thomas, of the Town of Midway, Norfolk County, Massachusetts, February 8.

In the machine for breaking and dressing flax and hemp and hulling grain; Evans Christian, Town of Philadelphia, Jefferson County, New York, February 8.

In thrashing grain and grass seed, and breaking flax; David W. Webster, of Amesburg, Massachusetts, February 9.

In the machine for cutting straw; Warren Cummins, of Livingston County, New York, February 11.

In the steam engine; Isaiah Jennings, New York, February 11.

In the grailing machine; Philo Pratt, of Meriden, Connecticut, February 12.

In slitting ivory into plates for combs, do. do. do.

In the specific steam engine; Augustus S. Kirk, of Smithfield Township, Jefferson County, Ohio, February 13.

In separating and collecting gold and silver from ores, earth, &c.; William H. Folger, Spartansburg District, South Carolina, February 13.

In a machine called the apple grater; Uri Emmons, of New York, February 13.

In the canal steam boat; John F. Wight, of Erie, Pennsylvania, February 14.

In the cooking stove; Ezekiel E. Bennett, of Kingsbury, Washington County, New York, February 15.

In Lotteries; William E. Spalding, of Brooklyn, Windham County, Connecticut, February 15.

In the thrashing machine; Elias B. Hort, of Charleston, South Carolina, February 18.

In the machine for cutting, sawing, and polishing marble; Archibald M'Allester, Town of Salem, Washington County, New York, February 18.

In the machine for swingling flax; Samuel Achey, of Heidelberg Township, Lebanon County, Pennsylvania, February 18.

In the water wheel; Joseph Torrey, of Revana, Portage County, Ohio, February 20.

In the mode of fastening window shutters; Truman Bartholomew, of New York, February 19.

In the hammer for cutting and dressing granite and other stone; Joseph Richards, of Braintree, Norfolk County, Massachusetts, February 20.

In the manufacturing or preparing cotton yarn wicks, used in making candles; George Dickinson, of New York, February 21.

In the spiral water wheel; James Kelly, of Jackson County, Ohio, February 21.

In the mode of purifying water; Christopher Hall, of Norfolk, Virginia, February 22.

In the thrashing machine; Edmund Warren, of New York, February 22.

In cast iron window sashes; Isaac M'Nary, of Stafford, Tolland County, Connecticut, February 23.

In steam boilers for using stone coal; James G. Wilson, of New York, February 22.

In the machine for spinning wool, flax, and hemp; Theodore Thomas Abbot, of Greenland, Rickingham County, New Hampshire, February 26.

In manufacturing shovels; Elizabeth H. Bulkeley, Colchester, Connecticut, widow of Chauncey Bulkeley, deceased, February 28.

NOTICES.

NEW ARRANGEMENT IN PUBLISHING AND DISTRIBUTING THE FRANKLIN JOURNAL.

The publishing office of the Franklin Journal, will, hereafter, be at the Hall of the Institute. The Editorial department will remain unchanged, but the work has become the property of the Franklin Institute. Mr. William Hamilton has been appointed *Actuary*, and all communications relating to the subscription to, or the distribution of the Journal, should, hereafter, be addressed to him at his office. Communications for insertion, or relating to the objects of the work, may be sent either to the Editor, or to the Actuary.

The distribution of a widely extended periodical, requires the undivided attention of an individual; and it is believed, that the new arrangement will insure a more prompt and efficient management in this particular, than has hitherto been found to be practicable, notwithstanding the care of the late agent. Although the principal publication office will be at the Institute, Mr. Dobson will continue to aid in the diffusion of the work, and will communicate to the Editor, or to the Actuary, whatever concerns its interests.

SPECIFICATIONS, AND ACCOUNTS OF AMERICAN PATENTS.

Since the last Number of this Journal was published, the Editor has been appointed *Superintendent of the Patent office*, and has commenced the performance of his official duties, at the city of Washington. The only change which this event will make in the publication of the Journal, will be highly favourable to it; as a valuable mass of information is thus placed at the disposal of the Editor, which will enrich his work, and put into the hands of the public the most important fruits of that mechanical genius for which our country is so eminently distinguished. Many useful inventions will thus become generally known, and their authors often be essentially benefitted, by having rescued from obscurity, or oblivion, those productions of their skill, to which they are frequently without the means of calling the attention of the public.

Upon this subject, some further remarks will appear in our next number, which could not be prepared in time for this, as it was in the press before the Editor was informed of his appointment.

Care will be taken, on the commencement of the next volume, to have the numbers issue simultaneously, at Philadelphia, and at the seat of the General Government.

New Mode of Refining Sugar.—When, in our last number, we proposed to publish the communications of Mr. J. J. Hawkins, on Howard's mode of refining sugar, we resembled those who determine to build without counting the cost. Although we had examined the process as it appeared in the successive number of the *Repertory of Patent Inventions*, we had forgotten its extent. We now find, that it occupies about forty pages of letter press, and would require six octavo plates for its illustration. The letter press might be easily condensed, but the illustrations are absolutely necessary, to the perfection of the article. The Athæneum, and other public institutions possess the *Repertory*, and the *few* who are particularly interested in mastering the subject, may find an opportunity of doing so, whilst the *great mass* of our subscribers might justly complain, were we to devote so large a portion of our work, to a subject which, although of great importance in itself, is by no means, one of general interest.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS,

Internal Improvements, and General Science.

JUNE, 1828.

ENGLISH PATENTS.

Russell's Hydro-Pneumatic Liquor Cock.

Fig.1.

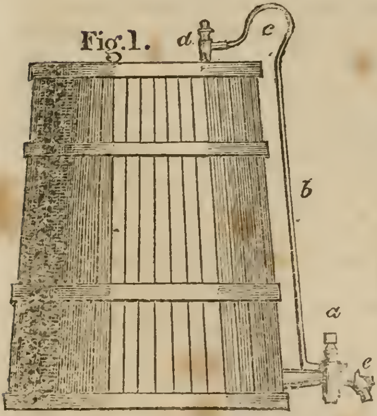
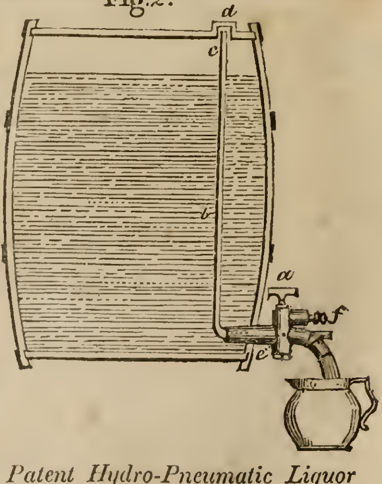


Fig.2.



Description of Mr. W. Russell's *Patent Hydro-Pneumatic Liquor Cock, with Air-Vent attached.*

It is well known that the admission or escape of air by the smallest aperture in vessels containing wine, beer, and other liquors, will soon destroy all their good qualities; at first they are rendered vapid or flat by the escape of the alcohol and the carbonic acid gas, upon which depend their strength, briskness, and flavour: and afterwards, they become sour by the absorption of the oxygen of the atmosphere, which is admitted. The defective manner in which such vessels have been usually stopped makes it highly desirable that something should be invented, the application of which would put it *out of the power* of any person, however negligent, to produce those injurious effects upon the liquor; and we are pleased to find, that this has been fully attained by Mr. Russell's Hydro-pneumatic Cock. By its means all casks or vats containing fermented or other liquors may be kept perfectly air-tight; but possessing at the same time the power of admitting such portion of air only, upon drawing off the liquor, as may be necessary to allow it to run out. The distinct operations of drawing off the liquor, and giving vent, are performed at the same instant of time, and by the same movement as in other cocks, viz. by merely giving the handle a turn, one quarter round; and upon turning the handle in the contrary direction, both the air and the liquor passages are effectually and simultaneously closed.

Fig. 1, is a view of a vat with the Hydro-pneumatic Cock and air tube, applied externally. The cock, *a*, is in this instance, to a certain extent, of the ordinary construction, but instead of having only one aperture for the liquor to pass, it has another just above it, of smaller dimensions, for the transmission of the air: upon turning the cock to draw off, the air enters into this smaller aperture above the liquor passage, then passes along its channel through the cock, into the metal tube, *b*, thence proceeding up to *c*, it enters the vat through the metal plug or ferrule, *d*, and is there discharged *above the surface of the liquor.*[*]

Fig. 2, is a section of a barrel, showing another modification of the apparatus, by which the air tube is placed internally; this method being considered preferable in large brewers' or distillers' vessels, and in situations where the tube would be exposed to injury if applied externally. Letters *a*, *b*, *c*, *d*, *e*, apply to the same parts in this figure, as in Fig. 1; but the aperture for the admission of the air in this cock is situated at the side (at *e*:) the operation of the cock is nevertheless the same with regard to the principle of the patent. In the present instance, the air aperture is so placed as to allow the application of Mr. Russell's improvement to Mr. Bramah's Patent Lock, as shown in the projecting barrel, *f*. For this latter highly ingenious application and improvement, Mr. Russell received an honorary medal from the Society of Arts. [*Register of Arts.*

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[*] It will be perceived that the article herein described is very different in its external appearance, as well as its application, to that subsequently sold in the shops as a substitute for the hydro-pneumatic, under the name of the syphon-cock. In Mr. Russell's, the air is conveyed by means of a long tube to the top of the vessel, or above the surface of the liquid, which keeps it undisturbed, and perfectly clear: but in the substitute above-mentioned the long tube is cut off close to the cock, so that the air is admitted at the bottom of the vessel directly into the body of the liquor; and by its forcible entrance, and bubbling upwards, it must necessarily disturb the light flocculent matter which generally floats at the lower parts of such vessels, and being thus frequently agitated, the whole contents must become more or less turbid. [*Editor of Reg.*

Remarks by the Editor.—It is now about twenty-five years, since Professor Hare invented a cock, similar in its mode of action to that above described. This is figured and described in the Transactions of the American Philosophical Society: it is constructed exactly like the common cock, but has a second channel, of a small size, above the ordinary vent, and passing like it, through the key, and into the vessel; through this small channel the air enters, whilst the liquor escapes at the larger.

It appears that a cock, in all respects similar to that invented by Dr. Hare, is now sold in London, under the name of the syphon-cock. The advantage claimed for the patent apparatus, is, that as the air does not bubble up through the liquid, there is no danger of disturbing it; its greater complexity, however, will prevent its general adoption: and this is a prophecy which may safely be made of all complex means of attaining simple ends, in the operations of every day.

Account of the Patent granted to William Choice *and* Robert Gibson, *for their Invention of certain Improvements in Machinery for Making Bricks.*

The drawing, which accompanies this specification, is an attempted representation of the machine in perspective, but so extremely rude and inaccurate, that we can only give a general idea of the intentions of the patentees, not being able to comprehend precisely how they propose to put those intentions into such a mechanical form as may be capable of acting.

The machine consists, in the first place, of an upright shaft, which is made to revolve by an arm with a yoke, to be attached to a horse as in ordinary horse mills. To the upper part of this central shaft, a large horizontal toothed wheel is affixed, which takes into another horizontal toothed wheel on the top of the perpendicular shaft of a pug-mill. Thus the traversing of the horse in its circular track, turns the central shaft, and all that is appended to it, and also drives the shaft of the pug-mill.

The pug-mill, as usual, is a large cylindrical tub set upon its end, containing the clay and other materials of which the bricks are to be made, and the perpendicular shaft turning within it, carries a series of knives, which, as they revolve, cut up and mix the clay and other materials together, and discharge it, after being so mixed and prepared, through an aperture near the bottom of the tub, on to a circular plate.

The bricks are to be formed in hollow moulds or boxes, about thirteen inches long, nine inches wide, and two and a half deep, with partitions dividing them into three, by which means three bricks will be made at a time. These boxes have three plungers within each, for the purpose of pushing the bricks out of the moulds when made.

At the lower part of the upright main shaft, three levers are attached in radial positions, by joints, which allow them to rise and fall perpendicularly. These radial levers are placed at equal distances apart, and at their outer extremities carry the mould boxes. About the middle of each lever, at its under side, a roller is attached, upon which rollers, the levers carrying the moulds run round as the upright shaft turns; and in their course the moulds receive the clay, and afterwards deposit it in the form of bricks, on to an endless band, which conducts them away to be dried and burnt.

It being now understood that the mould boxes traverse round, for the purpose of receiving the clay, and then discharging the brick, it remains to be explained by what means the boxes are made to rise and fall, and effect these objects.

On the floor of the machine, round which the levers and mould boxes traverse, three inclined planes are fixed, and over these, the rollers on the under side of the levers pass as they proceed round. Let it be supposed that one of the rollers is now ascending one of the inclined planes, the lever will be raised on its fulcrum joint, and the mould box lifted up; when the roller has reached the extremity of the inclined plane, the lever instantly falls down, and causes the mould box to strike on to a bed of soft clay, discharged from the pug-mill, and spread upon a circular flat plate beneath.

The mould having been thus filled with clay, it is slidden off, on to the surface of another flat plate, which, being wetted, smoothens the under part of the bricks as they slide over it. From the last mentioned plate, the mould box slides on to an endless band, upon which small boards are previously placed to receive the bricks, and a heavy block or rammer falling at this time on the upper surface of the mould box, (by the action of a lever depressed by a cam on the under side of the large horizontal toothed wheel as it revolves,) the projecting heads of the plungers are driven into the box, and the bricks forced-out of the moulds on to the endless band, which, as before said, conducts them away to be dried and burnt.

The roller under the lever, now rises up the second inclined plane, lifting the empty mould box, and when it arrives at the edge of the inclined plane, down falls the lever, and plunges the mould box into a vessel of water, placed beneath for the purpose of wetting the mould.

The third inclined plane effects the same action, and causes the mould to fall into a vessel of dry sand, which sand, adhering to the wetted surface of the mould, prepares it to receive the clay for another set of bricks, in the manner already explained.

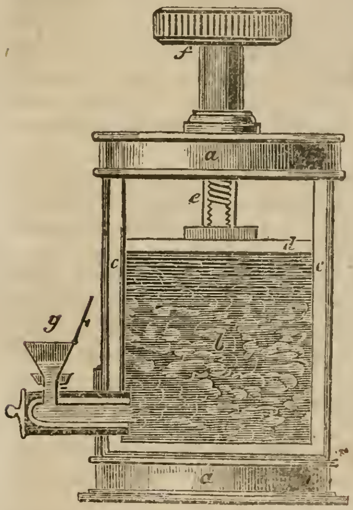
There being three mould boxes affixed to the three levers as above stated, their actions are simultaneous, and similar, every rotation of the horse with the central shaft producing nine bricks.

These are the intended operations of the machine, the leading features of novelty in which, are the levers that rise and fall with the moulds, in the way, and for the purposes above stated. There are several of the minor details of the machine, which we cannot comprehend from the specification, but we presume that its general construction will be sufficiently evident from the above.—[Enrolled June, 1826.] [*Newton's Journal.*

Edwards's *Patent Ink-stand.*

This is an excellent ink-stand, on account of its superior convenience, and stability; and, from its extreme simplicity, it is not liable to get out of order.

The construction will be readily understood by reference to the annexed figure, which gives a side view, or elevation, of the invention; those parts between the top and bottom *a a* are, however, shown in section, that its internal construction, and mode of action, may be made apparent. The external casing is of metal, bronzed, and elegantly wrought. The internal is a cylindrical glass cup *c c*, of considerable thickness, the upper part of which is closed by a glass piston *d* accurately fitting the cylinder, so as to allow of its being easily moved up and down. In this casing of glass is placed a quantity of loose horse-hair and wool, which imbibes and retains the ink, free from contact with the metal, that would otherwise become corroded. On the upper surface of the glass piston a hollow screw *e*, with a disk of metal at the end, is made to operate by pressure downwards; when the top piece *f* is turned by the finger and thumb, the latter turns the solid screw, and causes the hollow screw to advance or recede with a sliding motion, so as to press uniformly upon the piston without the friction of turning against its surface.



At the lower part of the ink reservoir an aperture is made, into which a tube is fixed, that conducts the ink to the little cup *g*, when the wool is compressed by a turn of the screw pressing down the piston. The little cup previously empty is thus instantly supplied with fresh ink with no more trouble than taking up a pen, and should a little more ink be forced into the cup than is necessary, by carelessly turning the screw too far, it runs over, and is caught in the little saucer shown below. When the inkstand is not in requisition, a half turn of the screw, the reverse way, causes the ink to flow back again; as the wool being thereby relieved of the pressure, re-absorbs the fluid.

The ink being thus returned into the reservoir, none can be spilled, even if upset; it is preserved from the contact of the air, consequently, from drying up, as well as from dust; and it may be instantaneously brought into use whenever required. These are advantages which will be appreciated by every body, but more especially by persons travelling, or in the army and navy.

Patent granted to PETER GROVES, ESQ. *for his invention of certain improvements in manufacturing White Lead.*

THE improvements proposed under this patent, are a new mode of producing a material called ceruse, or white lead, for the use of painters. It is proposed to take a quantity of sulphuret of lead, or lead ore, say half a ton, and having divided it into a powder, by pounding or rolling, then burn or roast it at a temperature below that which would melt the metal. After the ore has become cold, it is to be pulverized again, and reduced to the finest powder, and then well washed in water, taking off the lighter particles which float, and pounding the coarser again, until the whole is reduced as fine as possible.

This powder is now to be dried in pans, by exposure to the air, or in a suitable stove; and when perfectly dry, about two hundred weight of saltpetre is to be mixed with it, and the whole placed in a retort to undergo a sort of distillation.

The retort to be employed is a cylindrical vessel of iron, lined with lead, placed erect, within another as a jacket, and fastened together by flanches, forming a steam-tight joint, and leaving a space between all round and at bottom, for the passage of steam, by which the retort is to be heated.

In this vessel, the materials above prepared, are to be placed, and to be constantly agitated during the operation, by means of a perpendicular shaft with arms, which is introduced into the cylinder, and may be turned round by hand, or by any other convenient means.

Above the cylinder there is a vat, or cistern, intended to contain about two hundred weight of sulphuric acid, of a specific gravity of from 1·400 to 1·740. From this vat two pipes descend, one leading to the top of the cylinder, which admits the acid through a stopcock, the other to the bottom; through the latter of which, by means of a force pump, the acid is gradually injected into the cylinder at the lower part.

Steam from a boiler, under considerable pressure, is now admitted into the chamber surrounding the containing cylinder, for the purpose of heating the materials within. This operation is to be continued for several hours, the stirrer being continually turned, for the purpose of bringing all the particles of the material under the action of the acid and the heated vapour.

The top of the cylindrical vessel is of course to be closed, having an aperture with stuffing, through which the upper end of the spindle or shaft of the stirrer passes, but a tube is introduced into the top for the purpose of carrying off the vapour arising within the vessel, to a condenser, or into a chimney, or away into the open air, at a distance from the workmen. A hole is likewise made in the top with a stopper, by which small quantities of the material can be occasionally withdrawn, by a ladle, for the purpose of ascertaining the progress of the operation within.

The pulverized ore having been thus operated upon for several hours, it is afterwards allowed to remain in the retort for two or three days, or under some circumstances for a longer time, occasionally stirring it up, and drawing off the acid. It is then removed and washed in water in order to discharge the acid; and when this is done and the material dried, a similar quantity of saltpetre is again mixed with it in the retort, and the operation performed in a fresh quantity of acid as before.

The material being a second time withdrawn from the retort, it is to be thoroughly washed in warm water, until every appearance of acid has become completely removed; after which, being dried, and then ground in water, in the way white lead is usually treated, the material becomes fit for use.

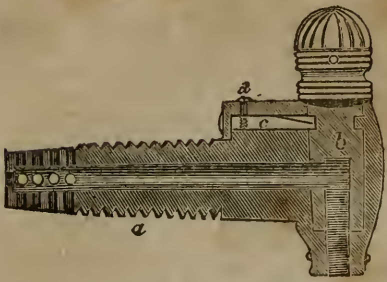
The patentee has proposed to employ sulphuric acid in the retort, but in the second operation he sometimes uses nitric acid, and under certain circumstances, other acids. He has described a particular formed vessel to be used as a retort, but has not exhibited any figure, as the vessel may be variously constructed, without deviating from the general principle. Steam, under great pressure, is proposed, and most approved as the heating material, but fire may be applied directly to the under part of the vessel, and effect the same object.

Thus a variety of changes may be made in the modes of conducting the operation, all of which come within the contemplation of the patentee, and are claimed by him under the present patent.—[Enrolled January, 1827.] [*Newton's Journal.*

Ridgeway's *Patent Porcelain Cocks or Taps.*

To construct a cock or tap for the drawing off liquids, of a material not subject to corrosion, and capable of bearing the blows to which they are liable, has been long a desideratum in this instrument. Messrs. J. and W. Ridgeway, of the Staffordshire Potteries, have invented and taken out a patent for an elegant and substantial apparatus of the kind; it is made of the strongest porcelain, or stoneware. The earths employed to produce the composition being similar to those in general use for the manufacture of porcelain. The materials being ground, mixed, and made into a paste, the several pieces of which it is made are moulded and cut to the required shapes; the circular parts are turned in a lathe, and those of a tubular form bored and turned by similar means. The parts are joined together by moistening the junctures, and afterwards baked.

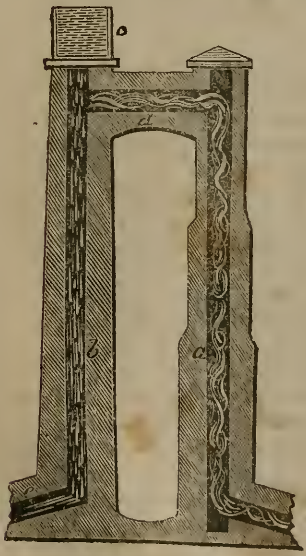
The form, as well as the interior construction, has some novelty; the annexed diagram gives a section of the body of the cock, of the form most approved by the patentees: *a* is the long tube, with a screw thread cut upon its external surface for the purpose of being screwed into the barrel; *b*, the plug, accurately ground and fitted into its place, in which a vertical perforation is made, by boring, so as to form a channel for the liquor, of equal diameter to that in the long



tube *a*; the plug is then bored horizontally, so as to open a communication with the vertical perforation, and also with the long tube when the plug is turned in the direction shown for drawing off the liquor. To secure the plug in its place, and produce a uniform action, it has a groove made three quarters round it, for receiving the end of the bolt *c*, which is fastened by the screw *d*.

The patentees have likewise described in their specification a "lock-cock," of which we give no figure, as it will be seen, by the construction of the above, that such an application is easily made. Under the bolt which keeps the plug down in its place, is fitted another bolt with a spring (like those in common cabinet locks,) and under this bolt a hole is made for the insertion of the key, which projects the bolt into a mortice hole in the plug; this hole being only open to the bolt when the liquor is turned off, the latter may thus be secured from depredation.*

Mr. Jeffery's *Patent Method of Condensing Smoke, Metallic Vapours, &c.*



The highly pernicious and even deleterious effects produced upon the inhabitants, the cattle, and the vegetation, by the smelting of ores, in the vicinity of extensive works of the kind, led Mr. Humphrey Jeffery, of Bristol, to devise the following plan of a flue as a remedy for the evil; for which a patent was enrolled by him several months ago.

The annexed figure gives a vertical section of the patent flue. *a* represents a common flue proceeding from any description of furnace; the top of which being closed, the vapour proceeds along the horizontal branch *d*, into the condensing shaft *b*; on the top of this second shaft is placed a cistern of water, the bottom of which is perforated with numerous small holes; and being duly supplied with water, a constant shower like fine rain is produced whilst the furnace is at work. The showering of the water causes a strong draft, by which the vapour is drawn into the current, and immediately condensed. The several matters thus condensed, run off along with the water through the passage *e*, into recipients suited to the nature of the products obtained by the operation. When only one common wall divides the smoke passage from the condensing shaft, a hole through the wall, of the same area as the chimney, will answer equally well.

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* A number of these cocks have been imported into the U. S., and are approved by those persons who have had them in use. Editor.

This invention is unquestionably most excellent and effectual, and the advantages attending it must be very great, where a sufficient supply of water can be obtained.

Dickenson's *Patent Metal Casks.*

This is a recently patented invention by Mr. Robert Dickenson, of the Eagle Foundry, Southwark. The object of it is the preservation of provisions and other materials used on ship-board, or for exportation; but chiefly for the use of the British Navy. The improvements relate to two distinct points; first, the mode of constructing the cask itself, and second, in a method of applying a coating, both outside and inside of the vessel, that shall be alike impervious to air and water.

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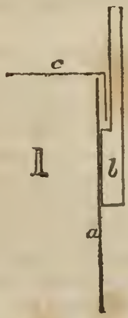

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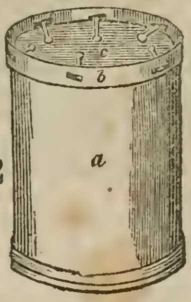
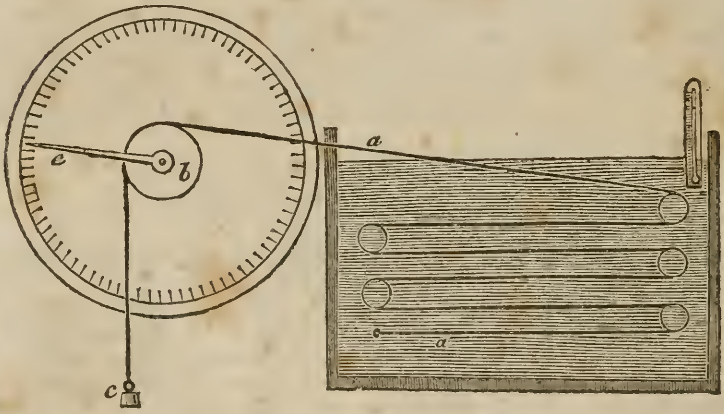


These casks are made of wrought iron, of a cylindrical form, with a seam, soldered or rivetted in the usual way. To strengthen the figure and adapt it for the reception of the heads, a strong iron hoop is rivetted to each end of the cylinder. These hoops are prepared at the iron works by rolling them into the form of a rebate, shown in section at *b*, *fig*. 1. By this diagram it is also shown that the hoop is fastened with the thickest part against the side of the cask *a*, about an inch below the extreme edge of the same; thus forming a deep groove between the sides of the cask and the thinnest part of the rebated hoop, for the reception of the flanch of the head *c*, which appears to be made by bending the periphery of the circular iron plate to a right angle with its plane. Previous to the driving down of this head, a sort of packing, composed of hemp bands, or curriers' leather shavings, is to be rammed into the groove, so as effectually to exclude both air and moisture. To secure the bottom head in its place, the thin projecting edge of the hoop is to be hammered down upon the bottom; and over this is to be rivetted a flat iron ring to serve the purpose of the ordinary chimes of casks, the exterior edge of which should extend a little beyond the periphery of the cylinder to defend the sides of the cask, in rolling it.

The upper head of the cask is so constructed as to be removeable at pleasure, the hoop which circumscribes it being the same as that on the bottom; but instead of being hammered down, it is left erect, as shown in *fig.* 2. The head is placed also within a similar groove, and is fastened down by means of a number of latch bolts. These latch bolts are attached to the head or moveable cover by means of a pivot at one end, upon which they turn, and are driven sideways into long slots made through the projecting hoop; which slots are not made in a parallel line with the top of the cask, but aslant, so that when the latch bolts are driven into them by a hammer, they draw the flanched head into the deep groove, which being previously packed in the manner before mentioned, makes the junction perfectly air and water tight. This kind of cover likewise admits of its being very readily removed, by driving back the latch bolts with a hammer; and the inconvenience formerly experienced from the smallness of the apertures in air tight vessels, is herein completely removed, the opening being as wide as the cask itself; so that larger matters may be stowed in them, and the packing and removing of the contents greatly facilitated.

Metal casks heretofore employed for similar purposes were usually coated with paint, to prevent oxidation, and render them water tight, which was found to communicate a bad flavour to the flour, biscuit, or other materials which they contained. To remedy this inconvenience, the patentee proposes to coat the casks or barrels both inside and outside, with any of the well known water-proof compositions, which, while they effectually prevent oxidation, will not communicate any unpleasant taint to the articles of food, even in the hottest climates. Without confining himself to any particular formula for the preparation of the coating or composition, which will be varied according to the nature of the contents of the cask, (to prevent those chemical changes which peculiar affinities would render them liable to) the patentee has selected the following, which may, in general, be used. To one pound of caoutchouc (Indian rubber) add 8 oz. of black rosin, and 2 oz. of Venice turpentine; let the caoutchouc be cut into small pieces, and expose the mixture to a heat of 160° for the space of 24 or 36 hours. When dissolved, it is to be spread upon canvass or other fibrous material, and then passed between cylindrical rollers to give it an even consistency. With this material the casks are to be coated both within and without, except in the case of dry goods, such as biscuits, flour, &c. when the coating of the exterior alone is considered sufficient; the interior surface of the iron may be bronzed in the same manner as gun barrels. For oils, tar, varnish, &c. the insides of the barrels have no coating, those materials being of themselves preservatives against oxidation. In some cases of dry goods, the inside may be coated with the thinnest and cheapest woven material, or even with paper, and these may be attached by any cheap kind of cement, by common glue, or paste; the object being to exclude the air and moisture in the cheapest, simplest, and most convenient manner. The patentee being the inventor and manufacturer of the wrought-iron buoys now so much in use, and other machines of the kind, it need hardly be added that he has succeeded in constructing these vessels in the completest and most effectual manner.

Description of GURNEY'S *Pyrometer. By* L. HEBERT, *Editor of the Journal of Arts.*



THE above engraving is a representation of Mr. Gurney's improved Pyrometer, which we saw some time since in that gentleman's lecture room, when he gave us permission to publish a description of it.

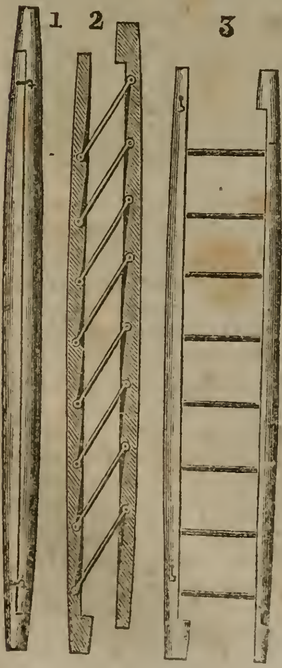
For ascertaining the relative expansibility of the various metals which can be drawn into wire, this invention is, unquestionably, the most sensible and accurate, of any hitherto constructed. And as the employment of pyrometers in this way constitutes their chief use, Mr. Gurney's will, probably, be very generally adopted; more especially on account of its great simplicity and little cost.

The wire *a* being attached at the lower end to a peg, is passed successively round four or five little pulley wheels, fixed by their axles upon a piece of board, and arranged in the manner shown. From the uppermost pulley, the wire proceeds out of the vessel and passes over a small central wheel *b* of the dial plate, and from thence descending, a weight *c* is appended to that end; which preserves the wire in a state of tension. Thus prepared, the apparatus is immersed in a vessel of water or other fluid heated to any desired temperature, which is ascertained by a thermometer being suspended therein. The expansion that then takes place by the increase of heat, is accurately denoted by the index *b*, and the graduated scale of the dial; the index being fixed to the central wheel, moves round as the wire elongates. Upon abstracting the heat, the wire contracts, and draws back the wheel and index to its original position.

By this very excellent contrivance it is evident that a table of the expansibility of the metals, at given temperatures, may be formed with the utmost precision, which would furnish information of a most desirable nature in many branches of the arts, but particularly in the construction of time-pieces.

The sketch for the preceding engraving was made from memory, and it now appears to us that the central wheel of the dial on which the index is fixed, is drawn rather too large in proportion; for it must be obvious that the smaller the dimensions of this wheel, and the larger those of the dial, the more sensible and delicate will be the indications of expansion. If the little wheel were to be one inch in circumference, and the circle of the scale 100 inches, then the elongation of wire to the extent of a tenth of an inch, would cause the index to move over a space of ten inches. We understand that Mr. Gurney constructed one on these principles, that showed even the variations in the temperature of the atmosphere, with very great exactness.

Description of GREEN'S *New Portable Folding Ladders.*



A MR. GREEN, of London, has invented a folding ladder, which is remarkably compact and portable.

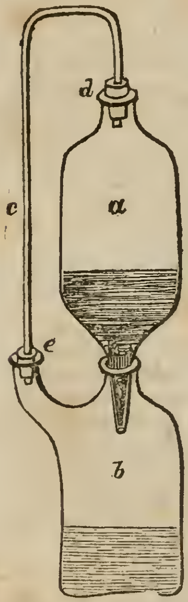
This convenient apparatus is delineated in the margin. Its construction is so apparent as to need but few observations. Fig. 3 shows the ladder opened out for use;—Fig. 2 the ladder partly closed, and shown in section, that the nature and adaptation of the jointed steps may be rendered obvious;—Fig. 1 shows the ladder folded up close, forming, exteriorly, a round pole tapered at each end, with all the steps enclosed within it.

Mr. Green has lately constructed a ladder for the purpose of rescuing persons who may have the misfortune to sink under ice; it is said to be admirably adapted to the purpose, and that it affords great security to the person employed as the deliverer; the invention has in consequence, we learn, been approved and rewarded by the Society of Arts.

MR. DONOVAN'S *Apparatus for filtering, in Closed Vessels.*

THE object of this very convenient apparatus, is the filtering of fluids out of contact with the atmosphere; alkaline solutions may thus be preserved in their caustic state, by preventing the absorption of carbonic acid by the alkali.

In the preparation of pure potash, when the carbonate of potash, the hydrate of lime, and the water, have been exposed for a while to each other's action, the mass becomes so absorbent, and of such a consistence, as to pass the filter very slowly, and with great difficulty. Experiencing inconveniences of this nature, Mr. Donovan contrived the annexed apparatus, by which the process of filtration may be conducted with the total exclusion of the atmosphere.



a is a bottle of *green** glass with a funnel shaped end inserted into another bottle *b*, the junction being luted or ground to fit closely; the neck *d* of the upper vessel has a cork tightly fitted to it, perforated in the middle for the reception of the glass tube *c*, which being bent downwards, enters the branched neck *e* of the lower vessel, thus connecting them together, and opening an air passage between them. The funnel-shaped end of the upper vessel has a piece of linen, loosely rolled up, placed in it for the purpose of filtering; but in filtering the corrosive acids, a stratum of pounded flints should be employed instead of the cloth.

To charge the upper vessel with the alkaline solution, the tube *c* must of course be removed, and the first droppings should be allowed to run to waste previously to the apparatus being fitted together, that no absorption of carbonic acid may take place in the filtered liquor. When the whole is properly closed, the filtration will proceed without the possibility of any absorption taking place.

Now it is evident that no liquor can fall from the upper vessel, without an equal volume of air entering it, and that none can enter the lower, without an equal bulk of air escaping from it. Both of these conditions, it is obvious, are fulfilled by the connecting tube *c*, the air being expelled from the lower to the upper vessel, at every dropping of the filtered liquid. The whole process is therefore conducted without access of more air than the vessels first contained, and in the most cleanly and perfect manner.

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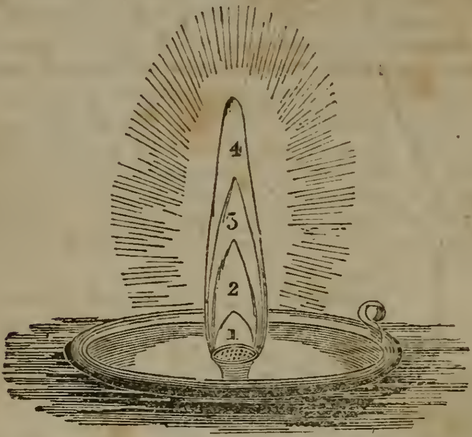
* Mr. Donovan recommends *green* glass in preference to white, being less liable to crack by the action of fixed alkalies.

The utility of this excellent contrivance is very extensive. The most volatile liquids, such as ether, alcohol, ammoniacal liquors, essential oils, &c. may be filtered without loss, as the vapours cannot escape during the operation; and by the exclusion of the atmosphere in the filtration of a variety of fluids, other injurious effects, to which they are subject, by the common process, may be entirely obviated.

The Graduated Nautilus Lamp, or New Floating Light.



The improvement which distinguishes this elegant little instrument from the ordinary self-generating oil gas float, being the means of causing the principle to be applied in a manner more extensively useful and convenient, will, it is trusted, gain it the approbation and patronage of all who have occasion for a night, or chamber light. The advantage peculiarly belonging to it, consists in its capability of yielding four distinct degrees of flame, so that it may be accommodated to the occasion; a larger or smaller one being used, according as convenient or necessary.

Directions.—Let the instrument float on the surface of the oil; then, by means of the little tongs, place carefully in the recess at the bottom, either of the two rings; apply a light to the top of the glass tube, and a medium flame will be produced, which, by taking out the ring, will be reduced to the first or lowest degree: this may at any time be raised to the second, third, or fourth degree, as suitable to the occasion:—to the second, by means of the small ring; to the third, by the larger ring; and to the fourth, by two rings.* For general service, the second and third degrees will be found most useful; the first, when a small, long continued, and economical light is required.

* These little rings operate merely as weights, which, by depressing the tube, occasion a greater supply of oil, and consequently a larger flame.—Ed.

On Chloride of Lime, or Bleaching Powder. By Andrew Ure, M. D., F. R. S., &c.

[Concluded from p. 324.]

Science has done only half her duty, when she describes the best apparatus and manipulations of a process. The *maximum* product should be also demonstrated, in order to show the manufacturer the perfection which he should strive to reach, with the *minimum* expense of time, labour, and materials. For this end I instituted the following researches:—I first examined fresh commercial specimens of bleaching powder; 100 grains of these afforded from 20 to 28 grains of chlorine. This is the widest range of result, and it is undoubtedly considerable; the first being to the second, as 100 to 71. The first yielded, by saturation with muriatic acid, 82 grains of chloride of calcium, equivalent to about 41 of lime; it contained besides 26 per cent. of water, and a very little common muriate ready formed. On heating such powder in a glass apparatus, it yielded at first a little chlorine, and then oxygen, tolerably pure. The bulk of chlorine did not exceed one-tenth of the whole gaseous product. Of the recently prepared powder of another manufacturer, 100 grains were found to give, by solution in acid, 23 grains of chlorine, and there remained, after evaporation and gentle ignition, 92 grains of muriate of lime, equivalent to about 46 of lime. Supposing this powder to have been nearly free from muriate, (and the manufacturers are anxious to prevent the deliquescent tendency which this introduces,) we should have its composition as follows:—

Chlorine,	23	3.5
Lime,	46	one atom 3.5 × 2 = 7.0
Water,	31	
	100	

This powder being well triturated with different quantities of water at 60°, yielded filtered solutions of the following densities at the same temperature:

		Sp. gr.
95 water	+ 5 bleaching powder,	1.0245
90	+ 10	1.0470
80	+ 20	1.0840

The powder left on the filter, even of the second experiment, contained a notable quantity of chlorine, so that the chloride is but sparingly soluble in water; nor could I ever observe that partition occasioned by water in the elements of the powder, of which Mr. Dalton and M. Welter speak. Of the solution 80 + 20, 500 grains, apparently corresponding to 100 grains of powder, gave off, by saturation with muriatic acid, 19 grains of chlorine, and the liquid, after evaporation and ignition, afforded 41.8 grains of chloride of calcium, equivalent to 21 of lime. Here 4 per cent. of chlorine seem to have remained in the undissolved calcareous powder, which indeed, on examination, yielded about that quantity. But the dissolved chloride of lime consisted of 19 chlorine to 21 lime; or of 4.5 atoms of the former, to almost exactly 5 (which is no atomic proportion) of the latter. The two-thirds of a grain of lime existing in lime water, in the 500 grains of solution, will make no essential alteration in the statement. Now the above bleaching powder must have contained very little muriate of lime, for it was not deliquescent. Being thus convinced, both by examining the pure chloride of my own preparation, as well as that of commerce, that no atomic relations are to be observed in its constitution, for reasons already assigned, I ceased to prosecute any more researches in that direction.

When we are desirous of learning, minutely, the proportion between the chloride and muriate of lime in bleaching powder, pure vinegar may be used as the saturating acid. Having thus expelled the chlorine, we evaporate to dryness, and ignite, when the acetate of lime will become carbonate, which will be separated from the original muriate by solution and filtration.

I have found, on trial, the method by carbonic acid to be exceedingly slow and unsatisfactory. After passing a current of this gas for a whole day through the chloride diffused in tepid water, I found the liquid still to possess the power of discharging the colour very readily from litmus paper. But the doctrine of equivalents furnishes a very elegant theorem with acetic acid, whose conveniency and accuracy in application I have verified by experiment. An apparently complex, and very important problem of practical chemistry, is thus brought within the reach of the ordinary manufacturer. Since common fermented vinegar is permitted by law to contain a portion of sulphuric acid, which avarice often leads the retailer to increase, we cannot employ it in the present research. But strong vinegar prepared from pyroligneous acid, such as that with which Messrs. Turnbull and Ramsay have long supplied the London market, being entirely free from sulphuric acid, is well adapted to our purpose. With such acid, contained in a poised phial, fully saturate a given weight (say 100 grains) of the bleaching powder, contained in a small glass matrass, applying a gentle heat at last, with inclination of the mouth of the vessel, to expel the adhering chlorine. Note the loss of weight due to the disengagement of the gas. (If carbonic acid be suspected to be present, the gas may be received over mercury.) Evaporate the solution, consisting of acetate and muriate of lime, to dryness, by a regulated heat, and note the weight of the mixed saline mass. Then calcine this, at a very gentle red heat, till the acetic acid be all decomposed. Note the loss of weight. We have now all the *data* requisite for determining the proportion of the constituents without solution, filtration, or precipitation by reagents.

Problem I.—To find the lime originally associated with the chlorine, or at least *not* combined with muriatic acid, and therefore converted into an acetate. *Rule.*—Subtract from the above loss of weight its twenty-fifth part, the remainder is the quantity of lime taken up by the vinegar.

Problem II.—To find the quantity of muriate of lime in the bleaching powder. *Rule.*—Multiply the above loss of weight by 1.7, the product is the quantity of carbonate of lime in the calcined powder, which being subtracted from the total weight of the residuum, the remainder is of course the muriate of lime. We know now the proportion of chlorine, lime, and muriate of lime, in 100 parts; the deficiency is the water existing in the bleaching powder. Thus, for example, I found 100 grains of a commercial chloride some time kept, to give off 21 grains of chlorine, by solution in dilute acetic acid. The solution was evaporated to dryness: of saline matter 125.6 grains were obtained, which, by calcination, became 84.3, having thus lost 41.3 grains. But $41.3 - \frac{41.3}{25} = 39.65$ = lime present, uncombined with muriatic acid. And $41.3 \times 1.7 = 70.2$ = the carbonate of lime in the residuary 84.3 grains of calcined salts. Therefore, $84.3 - 70.2 = 14.1$ = muriate of lime. Now, by dissolving out the muriate of lime, and evaporating, I got 14 grains of it, and the remaining carbonate was 70.3 grains. Hence this powder consisted of chlorine 21, lime 39.65, muriate of lime 14, and water 25.35 = 100.

Sulphate of indigo, largely diluted with water, has been long used for valuing the blanching power of chloride of lime; and it affords, no doubt, a good comparative test, though from the variableness of indigo it can form no absolute standard. Thus I have found 3 parts of indigo, from the East Indies, to saturate as much bleaching powder as 4 parts of good Spanish indigo.

Mr. Welter's method is the following:—He prepared a solution of indigo in sulphuric acid, which he diluted, so that the indigo formed $\frac{1}{1600}$ of the whole. He satisfied himself by experiments, that 14 litres (854.4 cubic inches, or 3.7 wine gallons English) of chlorine, which weigh 651½ English grains, destroyed the colour of 164 litres of the above blue solution. He properly observes, that chlorine discolours more or less of the tincture, according to the manner of proceeding, that is, according as we pour the tincture on the aqueous chlorine, and as we operate at different times, with considerable intervals; if the aqueous chlorine or chloride solution be concentrated, we have the *minimum* of discoloration; if it be very weak, the *maximum*. He says, that solution of indigo, containing about $\frac{1}{1600}$ part, will give constant results to nearly $\frac{1}{40}$; and to greater nicety still if we dilute the chlorine solution, so that it shall amount to nearly one-half the volume of the tincture which it can discolour; if we use the precaution to keep the solution of chlorine and the tincture in two separate vessels; and, finally, to pour both together into a third vessel. We should, at the same time, make a trial on another sample of chlorine whose strength is known, in order to judge accurately of the hue. On the whole, he considers that fourteen measures of gaseous chlorine can discolour 164 measures of the above indigo solution, being a ratio of nearly one to twelve. The advantage of the very dilute tincture obviously consists in this, that the excess of water condenses the chlorine separated from combination by the sulphuric acid, and confines its whole efficacy to the liquor; whereas, from concentrated solutions, much of it escapes into the atmosphere. Though I have made very numerous experiments with the indigo test, yet I never could obtain such consistency of result as M. Welter describes: when the blue colour begins to fade, a greenish hue appears, which graduates into brownish-yellow by imperceptible shades. Hence an error of $\frac{1}{20}$ may readily be allowed, and even more, with ordinary observers.

When a mixture of sulphuric acid, common salt, and black oxide of manganese, are the ingredients used, as by the manufacturer of bleaching powder, the absolute proportions are—

1 atom mur. of soda,	7.5	29.70	100.0
1 atom perox. of mang.	5.5	21.78	73.3
2 at. oil of vit. 1.846	12.25	48.52	163.3
	25.25	100.00	

And the products ought to be—

Chlorine disengaged,	1 atom	4.5	17.82
Sulphate of soda,	1	9.0	35.64
Protosulphate of mang.	1	9.5	37.62
Water,	2	2.25	8.92
		25.25	100.00

These proportions are, however, very different from those employed by many, nay, I believe, by all manufacturers; and they ought to be so, on account of the impurity of their oxide of manganese. Yet making allowance for this, I am afraid that many of them commit great errors in the relative quantities of their materials.

From the preceding computation, it is evident that 1 ton of salt with 1 ton of the above native oxide of manganese properly treated, would yield 0.59 of a ton of chlorine, which would impregnate 1.41 tons of slacked lime, producing 2 tons of bleaching powder, stronger than the average of the commercial specimens; or allowing for a little loss, which is unavoidable, would afford 2 tons of ordinary powder, with a little more slacked lime.

On Blowing Air into Furnaces by a Fall of Water. By the late William Lewis, M. D.

[Continued from p. 303.]

The force of the air may be determined in an easier and more simple method, by means of a glass pipe, open at both ends, with one end fixed in a basin of water. The basin may be hung in the upper part of the tub, or air vessel of our water machines, and the glass pipe let into it, through a hole in the top; what space may remain between the pipe and the hole being properly closed: the pressure of the air upon the surface of the fluid in the basin forces part of it up into the pipe; and this ascent will always be the measure of the power or density of the air. Water is here greatly preferable to the quicksilver, used in the same intention on other occasions, as it discovers smaller variations in the force; for being fourteen times less ponderous than quicksilver, an equal pressure forces it fourteen times higher in the pipe: the whole ascent of quicksilver, by the pressure of the air in the bellows, is so small as frequently not to exceed that part of the pipe which is inserted into the tub. Instead of a glass pipe, a copper or iron one may be used, and the ascent of the water measured, either by occasionally dipping a rod in it, or by means of a hollow copper ball, or other floating body, with a stem standing out of the pipe, and a proper weight below, to keep it upright. It must be observed, that the height of the water in the pipe is to be estimated from the surface of the water in the basin: whence the pipe ought to be of small bore, in proportion to the basin, that the water may not fall considerably in the basin, by the loss of that which rises in the pipe.

Dr. Hales found that a smith's bellows raised a mercurial guage about an inch, so that it would have raised a water guage about fourteen inches. The twenty-five ounces and a half, raised in M. Barthès's experiment, by the blast of the machine of St. Pierre, from an aperture of an inch and a quarter bore, English measure, are equivalent, to the ascent of water in the guage-pipe, forty or forty-one inches. I have been informed that the pipe by which the air is discharged into our iron furnaces, is, at least, of an inch and a half bore; and that the air, with this aperture to pass off by, ought to be of as great density as it can be reduced to by the human breath, in a confined space; which is such as to raise the water in the guage about fifty inches; in which case it is compressed into near an eighth part less volume than it commonly occupies in the atmosphere. But the quality of the fuel, and other circumstances, occasion such variations in this respect, that no general standard can be laid down. I have been assured that a charcoal fire will be excited as strongly, by such a blast as raises the guage thirty-six inches, as a fire of coaked pit-coal will be, by one of fifty inches.

II. *Observations on the air-vessel.*—The structure of the air-vessel, or tub, at the bottom, is, in great measure, independent of that of the rest of the instrument; the same air-vessel serving equally for different kinds and sizes of these machines, while the perfection of the other parts, consists in their adjustment and proportion to one another.

The office of this air-vessel being only to serve as a reservoir for the air, and to suffer the waste water to pass off, no great care seems to be needful for regulating its dimensions; and as the stone which is placed in it under the pipe, serves only to receive and support the fall of water, or to occasion the water to be dashed into small particles, that the air may be more effectually extricated, its distance from the pipe seems also to require no exact adjustment. There are, however, some particulars in regard to the size of this vessel, and the disposition of some of its parts, which appear to deserve attention.

The guage mentioned in the preceding article, will be a useful addition to it; showing at all times, by inspection, the force of the blast, and thus enabling the workman to judge whether it is sufficient for the purposes intended, and giving him notice of any failings that may have happened in the machine; as whether any air escapes through the joints, or a crack, or whether the choak, or throat of the funnel, is obstructed by stones, or other matters brought by the stream.

All the writers I have met with, who give any account of this kind of blowing machines, seem to suppose the water within and without the air-vessel, to be upon a level. But as the air in the vessel is so far compressed as to be able to raise the water in the guage to a considerable height, it must necessarily act with equal power on the water below it; and if this water can pass off freely at the bottom, it must be depressed, as much as that in the guage pipe, is raised. The water within and without the vessel is exactly in the same situation with that in the basin and pipe of the guage, excepting only that the former receives a continual supply within, which passes off as fast on the outside. The excess of the height of water on the outside of the vessel, above that of the water within, appears to be the very power by which the air is compressed, and driven into the furnace.

To be further satisfied of this depression of the water, I used, for the air-vessel of a small machine, a tall glass, without a bottom; seven or eight inches of its lower part being immersed into a tub of water. As soon as the machine began to play, and the guage to rise, the water within the glass sunk lower than that in the tub on the outside; and the depression of the water, and rising of the guage, were, as nearly as could be judged, equal, and kept pace with one another. In a little time the water was forced quite out of the glass, and the air following it rose in bubbles to the top of the tub.

The bottom of the air-vessel ought, therefore, to be sunk, at least as much below the level where the external water passes off, as the guage is expected to rise; for, otherwise, before the air is sufficiently compressed, to raise the guage to the due height, it will force all the water out below, and in part escape itself by the same aperture. Hence, the depth of the air-vessel, in any of these machines where the water has a free passage at the bottom, gives a power which the force of the blast in that machine can never be made to exceed; thus, at Lead-hills, the water being only of the height of two feet from the bottom of the vessel to the level of the bank where it runs off, the air can never be compressed further than to be able to support a column of two feet of water, or to raise the guage to that height; whereas, in the machine of St. Pierre, the compressure is about two-thirds greater.

The sinking of the water in the air-vessel may, indeed, be prevented, by making the aperture in the bottom, through which the water is discharged, of such a size that the pressure of the air may be able to drive through it no more water than is received at the top. But such an adjustment would be, apparently, very difficult; and though it should be exactly hit, yet if the quantity of water received was not always the same, it would scarcely be possible to avoid, either a depression or elevation of the water in the air-vessel.

Though the depth of water be sufficient to resist the pressure of the air, it will be easily conceived, that if there were no solid body to support the fall, the great force of the stream, falling from such a height, would push down, or dash about, great part of the water in the bottom, so that the air would get at the hole, and, in part, make its escape with the water. It may be presumed, that even the drops of water rebounding from the stone, and falling down again, have a like effect, though in a lesser degree; for drops falling through the common atmosphere into water, carry air with them, which afterwards rises in bubbles, as may be observed in heavy rains; and it is not to be supposed that the drops should not here also carry into the water some of the compressed air which surrounds them, and is entangled between them. Though part of the air which thus passes into the water doubtless rises again in bubbles, as appeared in using the glass vessel above-mentioned, yet part may also be pushed so low, as to escape through the hole, and discover itself by bubbles in the water on the outside of the vessel, and which I several times observed before the water was driven entirely out of the glass.

M. Barthès likewise takes notice of air being either thus carried down into the water by the drops, or introduced into the cavities which they form in falling. In order to prevent it, he recommends making a partition across the tub at the level of the stone, with only a hole at one side, and this in the part most remote from the pipe through which the water falls; the rebounding drops are received upon the board, and run off gently through the hole in the water underneath.

The inconvenience may be prevented also, as effectually, and with more advantage in other respects, by making the air-vessel of a very considerable depth, below the surface of the stone; it may be sunk several feet into the ground, below the level of where the outward water runs off, so as always to have a column of water in the vessel, of any height required, or of a height which shall prevent any air from passing down to the bottom. This structure would free the workman from any care about increasing or diminishing the aperture, or regulating the height of the water; for, if the deep vessel has an aperture in its lower part, large enough to discharge all the water that can fall into it through the pipe in the top, or, for the greater security, a great deal larger, its magnitude being of no inconvenience, if this vessel is sunk into a pit of water, up to the level of the stone, or to a certain height above it, and if the pit has a drain sufficient to carry off what more water it may receive, we may be sure that the water will be always high enough in the vessel; because the pressure of the water on the outside will keep it so, and the pressure of the air within the vessel, will always keep it below the surface of the stone.

*The air extricated from the water is always moist;** when let off at a little way above the stone, I have often observed it to have drops like dew on any solid body opposed to it.

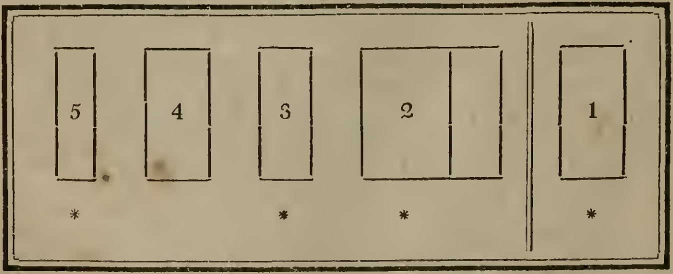
The joints should be well secured, to prevent the escape of any air through them: the stone for receiving the dash of water, should be placed as much below the level of where the water runs off, as the guage is expected to rise, and the pipe should reach as low as within five or six inches of the stone. It would, perhaps, be of some advantage, to have the surface of the stone a little concave, so as to occasion the watery drops to be rather dashed backwards towards the stream, than thrown upwards, through the cavity of the vessel.

[TO BE CONTINUED.]

A descriptive Account of the several Processes which are usually pursued, in the Manufacture of the Article known in Commerce by the name of Tin-Plate. *By* SAMUEL PARKES, F. L. S., *&c.* *Abridged for the Boston Journal of Science, from a paper read before the Philosophical Society of Manchester.*

[Continued from p. 328.]

IN the first place, the wash-man prepares an iron pot which he nearly fills with the best grain tin in a melted state—another pot of clean melted tallow, or lard free from salt—a third pot with nothing within it but a grating to receive the plates—and a fourth, called the *listing-pot*, with a little melted tin in it, about enough to cover the bottom to the depth of a quarter of an inch. The whole will, however, be better understood by referring to the following drawing, which exhibits the several vessels in the order in which they stand in the manufactory, all supported by substantial brick work.



The building in which the pots are fixed is called the *Stow*. The plates are worked from the right to the left of the stow, as will be evident by attending the uses of the several pots.

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* Hence its superior value for exciting the fires of forges, steam-engine boilers, &c.; and Mr. Nicholson endeavoured to increase its *moistness*, by the admixture of *steam* with it. EDITOR *Tech. Rep.*

No. 1. Represents the tin-pot.
2. The wash-pot with the parting within it.
3. The grease-pot.
4. The pan, containing a grating at the bottom.*
5. The list-pot.

The drawing represents the *surface* of the pots. The asterisks show the places where the workmen stand, and also mark those pots which have heated flues under them. No. 4 has no fire under it.

The parting in the wash-pot No. 2, is a late improvement. The design of it is to keep the dross of the tin from lodging in that part of the vessel where the last dip is given to the plates. By using the *common* tin in the first process of tinning, much oxide, or dross, adheres to the surface of the plates, and this runs off in the wash-pot, and comes to the face of the new metal—but this parting enables the operator to prevent it from spreading over the whole surface of the pot. Were it not for this parting, the wash-man must skim the oxide off the fluid metal every time he puts plates into it.

The pots, of which I have given a sketch, being all in a state of fitness, the wash-man commences his part of what remains of the business, by putting the plates, which have undergone the various operations hitherto described, into the vessel, of grain-tin, called the wash-pot.† The heat of this large body of melted metal soon melts all the loose tin on the surface of these plates, and so deteriorates the quality of the whole mass, that it is usual, when sixty or seventy boxes have been washed in the grain-tin, to take out the quantity of a block, say three hundred weight, and replenish the wash-pot with a fresh block of pure *grain*-tin. These vessels generally hold three blocks each, or about half a ton weight of metal. That which is taken out of the wash-pot when it is replenished with pure metal, is given to the tin-man to put into his pot.

When the plates are taken out of the wash-pot, they are carefully brushed on each side with a brush of hemp of a peculiar kind, and made expressly for the purpose. As this part of the business requires considerable adroitness and expedition, it may be worth while to explain it a little more in detail.

The wash-man first takes a few plates out of the wash-pot, and lays them together before him on the stow,—he then takes one plate up with a pair of tongs, which he holds in his left hand, and with a brush held in his right hand brushes one side of the plate—he then turns it, and brushes the other side, and immediately dips it once more into the hot fluid metal in the wash-pot, and without letting it out of the tongs, instantly withdraws it again, and plunges it into the grease-pot (marked No. 3.) adjoining to the wash-pot from whence he had just taken it.

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* This pan is designed for the reception of the plates as the boy takes them out of the grease-pot. It has no fire underneath it.

† None but *grain*-tin is ever put into this vessel, for the whole of the common tin which is consumed in such manufactories, is used in the *first* process, *viz.* that which is called *tinning*.

A person who has not seen the operation, can form but a very inadequate idea of the adroitness with which this is performed—practice, however, gives the workman so much expedition, that he is enabled to make good wages, although he obtains only three-pence for the brushing and metallic-washing of 225 plates. I am informed that an expert wash-man, if he makes the best of his time, will wash 25 boxes, consisting of 5,625 plates, in twelve hours; notwithstanding every plate must be brushed on both sides, and dipped twice into the pot of melted tin.

Why the plates should be dipped *twice* during this part of their manufacture, may perhaps require some explanation. It must be recollected that they are brushed quite hot, and before the tin is set, therefore, if they had not the last dip, the marks of the brush would be visible. Moreover, the brush takes the greatest part of the tin off them, so that if they were removed to the grease-pot without being re-dipped, the hot grease would take off what remained.

The only use of the grease-pot is to take off any superfluous metal that may be upon the plates—but this is an operation that requires great attention, because, as the plate is immersed in the grease while the tin is in a melting, or at least in a soft state, upon it, a part *must run* off, and the remainder becomes less and less while the plate continues in it; therefore, if these plates should ever be left in the melted tallow longer than is absolutely necessary, they will doubtless require to be dipped a third time in the tin. On the other hand, if the plates were to be finished without passing through the grease, they would retain too much of the tin, which would be a loss to the manufacturer, and, besides, the whole of the tin would appear to be in *waves* upon the iron.

It is also equally necessary to attend to the temperature of the melted tallow, which must be colder or hotter in proportion as the plates are thicker or thinner; for if, when the tallow is of a proper temperature for a thin plate, a thick one was to be put into it, it would come out, not of the colour of tin as it ought to be, but as yellow as gold. The reason of this is evident. The thick plate contains more heat than a thin one, and consequently requires the tallow to be at a lower temperature. On the contrary, if a parcel of *thin* plates were to be worked in a pot of tallow which had been prepared for *thick* plates, such a pot would not be hot enough to effect the intended purpose.

It is a common observation that, in most of our manufactures, and in all chemical speculations, theory and practice are generally at variance; but there are few manufactures, perhaps, where there are so many minutiæ which would escape the notice of a casual observer, and yet that require to be carefully attended to, in order to produce a good result, as in that which we have now been describing —and should the perusal of this paper occasion but one individual to pause, who was about to enter into a new concern with which he was only partially acquainted, I shall have written to a good purpose.

But to return to the process. When the plates are sufficiently brushed, they are again immersed, one by one, in the pot of melted tin, as has already been remarked, and immediately from this, they are put into the pot of tallow above mentioned. This pot has pins fixed within it, in such a manner as to keep the plates from touching each other: and this part of the process is conducted in the following manner:

When the wash-man has passed *five* of the plates through the melted tin, and from thence into the pot of tallow above mentioned, a boy takes out one of them and puts it into the empty pot to cool, and the wash-man puts it into the *sixth* plate. The boy then takes out a *second* plate, and lays it to cool likewise, when the man puts in his *seventh*, and so they go on, in this regular manner, until the whole of the parcel is finished.

In consequence of the plates being immersed in the melted tin in a vertical position, there is always, when they have become cold, a wire of tin on the lower edge of every plate, which is necessary to be removed, and this is done in the following manner:

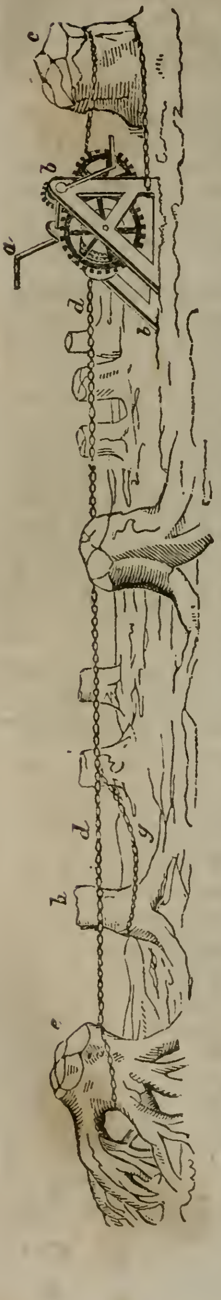
A boy, called the list-boy, takes the plates when they are cool enough to handle, and puts the lower edge of each, one by one, into the list-pot, which is the vessel that was before described as containing a very small quantity of melted tin, and the same as that which I have marked No. 5. When the wire of tin is melted by this last immersion, the boy takes out the plate, and gives it a smart blow with a thin stick, which disengages the wire of superfluous metal, and this falling off, leaves only a faint stripe in the place where it was attached. This mark may be discovered on every tin plate which is exposed for sale; the workmen, in the manufactory of them, call it the *list*.

Nothing now remains but to cleanse the plates from the tallow. This is done by means of bran, and as they are cleansed they are put into strong wooden boxes, or boxes of *sheet-iron*, made exactly to fit them; and this completes the whole business.

Method of Eradicating the Stumps of Trees.

[Abbreviated from the Transactions of the Society of Arts.]

In the clearing of woodland the extirpation of stumps and roots is the most laborious part of the process. In British America, the ordinary method is to allow the stumps to remain for a number of years, according to their size. During this period the smaller fibres gradually decay, and the root itself is each year removed a little from its original position, by the frost. When the farmer judges that time has so far produced decay as to render the removal of the stumps and roots practicable by the usual means, he pitches upon the spring of the year when the soil has been loosened by the returning heat, and with the assistance of four or five men, and a couple of pairs of oxen, he effects his purpose, by a great deal of labour, and under a disadvantageous application of power, owing to the softness of the ground.



In 1821, J. Mackay, Esq. of Pictou, Nova Scotia, cut down the trees and removed the timber from a field of 10 acres. The following were the means adopted by that gentleman for clearing the ground of the stumps and roots, which proved so effectual, that, with the assistance of four men, he cleared, upon an average, 80 stumps a day, and with them every root which could impede the progress of the plough.

A ship's winch, or moveable crane, was the machine used for gaining a great mechanical power; this was brought into the middle of about an acre of stumps, and fastened to the largest of them. From the barrel of the winch a chain proceeded, which extended to the farthest stump in the piece; a number of shorter chains were also provided, each having a ring at one end, and a hook at the other. By passing the hook through the ring, they were fixed upon the stumps nearest to that to which the chain of the winch was attached; and when it was raised, these chains were, in succession, hooked to the leader, so that the winch was employed without interruption, till the nearest stump was extracted. In clearing Mr. Mackay's field, five hands were employed; two at the winch, two in fixing the chains, and one at the stump to be raised. When the stump was large, those who attended the chains occasionally assisted in turning the winch.

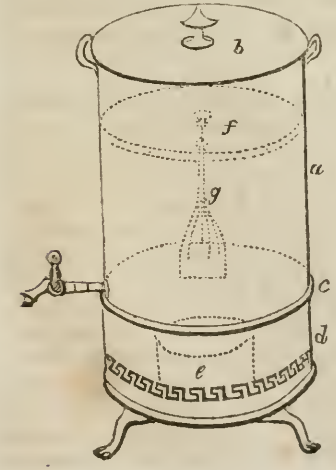
Reference to Engraving.—*a a* the two winch handles of the frame *b b*, which is chained to the largest stump, *c; d d* the leading chain, proceeding from the barrel to a distant stump *e*, which is in the act of being raised. *g* a shorter chain round the stump *h*, to be hooked on to the leading chain *d d*, as soon as it has raised the stump *e*, and has been disengaged from it, so that the different stumps are raised in succession from the farthest to the nearest. The winch is then removed to face the next portion, and the chain extended to the farthest it can reach, while the shorter chains are attached to the right and left stumps, and hooked on, in succession, to the leading chain, and thus continued until a whole circle round the winch has been cleared. Should the stump to which the winch is attached, be liable to give way, it will be requisite to lash it to one or two in the rear, to secure the purchase.

EVANS'S *Improved Coffee Urn.*

IN the ordinary method of roasting coffee, it is well known to chemists, that acetous acid is generated; and when the berry is subsequently ground and infused, this acid is given out in a greater or lesser quantity, according to the time the coffee remains in the liquor. To obviate this inconvenience, an apparatus was contrived (called a *biggin*) in which the coffee is put into a bag suspended to the rim of the vessel, and boiling water having been poured through, it is separated from the liquor as soon as the infusion is made. In this manner an infusion is produced nearly free from acid, and possessing much of the aromatic fragrance.

In the coffee roasted by the *patent* apparatus, the ingenious inventor has contrived in his process to get entirely rid of the acetous acid; it follows, therefore, that in making an infusion of the patent coffee, there is no necessity for keeping the water separate; and, consequently, that an infusion of a much richer quality may be obtained by allowing the powdered coffee to lie a considerable time immersed: and hence it has been observed, that the last cup is better than the first, while it is the contrary in ordinary coffee.

Now the process adopted with the biggin is an uneconomical one, as the water, being merely poured through the powdered coffee, or immersed for a short time, dissolves only a small portion of the soluble matter; consequently much of the rich properties is abandoned in order to avoid the acid, and retain the aromatic parts. In the patent coffee there is no acid to be extracted, therefore the infusion may be continued until all the nutritious matter is obtained from it; but as the fragrant principle is of a very volatile nature, and as the retention of it to the greatest extent is a desideratum in coffee-making, Mr. Evans has contrived the apparatus delineated below, which answers the purpose extremely well.



a shows the body of the vessel to be of a cylindrical form, *b* is the cover or top, and *c* the bottom; *d* is the stand, containing a cylindrical recipient for a lamp or a heater; *f* is an air-tight, *floating* piston, with a hook underneath, for suspending the bag of ground coffee *g*.

The floating piston is made of two thin metal plates, with a hollow space between them, capable of holding a sufficient quantity of air to render itself and the bag of coffee, buoyant; the peripheries of the plates are connected by a rim at right angles, and properly soldered. The piston is, of course, accurately fitted to the cylinder, but so loosely as to allow it to rise and fall with the liquid on which it rests, quite freely. By this means the surface of the liquor is preserved from the contact of the air, and notwithstanding the liquid is at a boiling heat, no perceptible vapour arises, which might be supposed would escape by the edges of the floating piston; the aromatic principle is thus wholly retained, or very nearly so, until the last cup of coffee is drawn off. The air having no access to the liquor, it boils at a lower temperature, and is kept hot for a much longer time.

When coffee is ground to a fine powder, and placed loosely among the water, the floating particles are a long time in subsiding; in such cases, the addition of a small quantity of animal gelatine is resorted to, to expedite the clearing; and to save the trouble of this operation, the suspending of the coffee in a bag was introduced. Mr. Evans has, however, found, that when coffee is thus suspended in a mass, a great portion of the extractive matter remains in it, undissolved; he has therefore suggested a further improvement, and is now, we are informed, having an urn made accordingly. In this, the coffee is to be contained in a cylindrical box, which is to rest upon a ledge at nearly the bottom of the urn, occupying the whole of its area; the top and bottom of the box to consist of two fine strainers, similar to those used in sieves. The water will be supplied by means of a tube extending from the top of the vessel to the bottom, from whence it will ascend through the strainers, and the coffee contained between them; which, being unconfined, every particle will be kept in agitation by the boiling water, and fully operated upon. The floating piston, which is by far the most valuable part of the invention, will, of course, be employed in this improved modification, as in the one previously described.

Method of making a cheap Soda Liquor, without Crystallizing, for the use of the Turkey-red Dyers. By Mr. CHARLES CAMERON, *of Glasgow.*

As the Turkey-red dyers are the great consumers of the common soda of commerce, it occurred to me, about four months ago, that they might make their own alkali, by the cheap and simple process of decomposing muriate of soda by pearl-ash, and thus procure a liquor equally pure, without the tediousness and expensive operation of bringing the soda to the state of crystal. I pointed out the following plan to a Turkey-red dyer here, who immediately put it in practice, and it is now gradually adopting by the trade.

Into a cast-iron boiler capable of holding 450 gallons of water, I put ten hundred weight of pearl-ash (first sort,) seven hundred weight of muriate of soda, and four times this latter weight, of water, applying heat, and stirring the mixture until the salts are dissolved. After boiling for some time, the muriate of potash begins to crystallize on the surface. As the boiling is still continued, the muriate of potash is rapidly forming, and is lifted out of the vessel by means of a ladle pierced with small holes, and is thrown into a vessel placed in an inclined position, with its end, or side, a little within the edge of the boiler, which allows any of the liquor that may have been carried over, to drain back again into the pot. The boiling is continued until nearly the whole of the muriate of potash is deposited and taken out. The liquid is then removed into another vessel, either of cast iron or wood lined with lead, and allowed to remain until it has cooled to the temperature of sixty degrees, during which time it parts with the rest of its muriate; it is then run off into another vessel, and diluted with water to twenty degrees specific gravity, more or less, at pleasure, which prevents the soda from crystallizing, and gives a uniform strength of liquor, equally pure with the best crystallized soda, and at about half the price. The above weight of pearl-ash and muriate of soda, produces a mineral alkali equivalent in quantity to what is contained in one ton of soda of commerce, the best of which does not exceed 22 per cent.

Present price of soda, 22*l.* per ton,	£.	*s.*	*d.*
Price of pearl-ash, first sort, per ton, . . .	28	0	0
14 cwt. of muriate of soda, 30*s.* per ton, . .	1	2	0
	29	2	0
These produce 1¼ tons of muriate of potash, price 5*l.* 10*s.*	6	17	6
Cost of alkali, equivalent to 2 tons of soda, .	22	4	6

The process is so simple, that one workman can decompose one or more tons per day, dependent on the size of his vessels. As the Turkey-red work consumes from forty, to two hundred and fifty, tons annually, according to the extent of its establishment, it is of great importance to that valuable manufacture. I can claim no merit in merely decomposing muriate of soda by potash, as that is a fact long known; what properly belongs to me, is, being the first to point out to the trade a simple and unexpensive method of making their own alkali, without being at the expense of erecting additional premises, and extensive apparatus, required for the purpose of crystallizing; a common boiler and two or three other vessels being all that is requisite.

Rolling Press for Bookbinders, by Mr. W. BURN, *of Kirby street, Hatton-garden, London.*

[From the Transactions of the Society of Arts.]

A COMMITTEE met at Mr. Burn's house, for the purpose of examining the rolling press employed by him as a substitute for the beating which books require previous to being bound. The press consists of two iron cylinders about a foot in diameter, adjustable in the usual way, by means of a screw, and put in motion by the power of one man, or of two if more convenient, applied to one or two cranked handles. In front of the press sits a boy who gathers the sheets into packets, by placing two, three, or four, upon a piece of tin plate of the same size, and covering them with another piece of tin plate, and thus proceeding by alternating tin plates and bundles of sheets, till a sufficient quantity have been put together, which will depend on the stiffness and thickness of the paper. The packet is then passed between the rollers, and received by the man who turns the winch, and who has time to lay the sheets on one side, and to hand over the tin plates by the time that the boy has prepared a second packet. Among other books that were pressed in presence of the committee, was a minion bible, which was passed through the press in one minute, whereas the time necessary to beat the same, would have been twenty minutes. It is not, however, merely a saving of time that is gained by the use of the rolling press, the paper is made smoother than it would have been by beating, and the compression is so much greater, that a rolled book will be reduced to about five-sixths of the thickness of the same book, if beaten. A shelf, therefore, that will hold fifty books, bound in the usual manner, would hold nearly sixty of such, if bound in Mr. Burn's manner; a circumstance of no small importance, when it is considered how large a space even a moderate library occupies, and that bookcases are an expensive article of furniture.

Illuminated Clock Dials.

We are happy to observe that this very simple and ingenious mode of increasing the utility of turret clocks, is now coming into very general use. Our readers will no doubt recollect, that the iron church at Glasgow, was first illuminated by means of a parabolic reflector; and since that, the metropolis has furnished three very successful instances of the employment of transmitted light for the same purpose. They are now enabled to add another large clock to the list, as the church clock of St. Mary, Islington, was illuminated on February 25, for the first time. The dial is the largest which we have yet seen; the diameter to the extremity measures nine feet, and the illuminated part, eight feet; the length of the figures, fifteen inches; the minute hand, four feet, and the hour hand, two feet nine inches; the height of the dial from the ground is sixty-five feet. As the clock struck seven, the gas was turned on, and the joy-bells rang a merry peel: the effect was very beautiful, and the crowds who had assembled before the church, testified their approbation by repeated cheers. The clock can be seen in both roads, and very distinctly from Cloudsley Terrace—a distance of about three quarters of a mile. Its utility is quite manifest, particularly to those who travel by night: and where it has been adopted upon the principles approved of by the Society of Arts, namely, in St. Giles's and Whitechapel, it has given great satisfaction. Each of the diameters of the dials in the two latter places, does not exceed six feet and a half, being less than the one in Islington by two feet and a half.

Some account of the Manufacture of Glass in India: extracted from a journey through the countries of Mysore, Canara, and Malabar.

By Francis Buchanan, M. D.

Notwithstanding the extent of the British possessions in India, we know but little of the actual state of the manufactures of that country. It is true, that within a few years, considerable information has been given upon this subject, but this information is generally contained in large and expensive works, not accessible to the greater number of readers. From what has appeared, it is evident that the artisans and manufacturers of England, and of this country, can derive but little practical benefit, from the knowledge in question, as the materials employed, in most instances, differ essentially from those at our command; and the processes, and instruments of manufacture, are of a very rude kind, bearing little or no analogy to the machines which, in our workshops, appear to operate without human agency. The east Indian seeks for no improved method, which shall enable him to cause a few to perform the labour of the many; the political and moral institutions which control his actions, and form his habits, forbid such a thought; his very life depends upon the continuance of the existing state of things. An account of the arts of India is, therefore, much better calculated to gratify our curiosity, than to improve our processes.

We have not the work from which the subjoined extracts are made, but copy them from Mr. Gill's Journal, and shall hereafter give some further information on the same subject, from the narrations of other residents in India. Editor.

I went to Chinapatam or Chinapattana, which was formerly the residence of a Polygar family, who seem to have risen into power about five centuries ago.

Glassware is one of the manufactures of this place. It is made by two operations. In the first, from the raw materials are formed masses of glass; in the second, these masses are wrought up into small bottles and ornamental rings for the arms of women.

Two or three of their furnaces are in general constructed in the same building, which is erected in form of a terrace against one of the walls of a yard, and which, where there are three furnaces, may be six feet high, twelve broad, and twenty-six long. The furnace is arched over, and, in the centre of the summit, has a round opening, about two feet in diameter. This is covered by a flat stone, in the centre of which there is an aperture. Near the level of the surface of the ground, within the furnace, is a shelf or platform, which has also an aperture in its centre. This platform thus divides the furnace into two different cavities, the lower of which contains the fuel, which is introduced through an opening at the bottom of a niche, or arched vault, that is formed in the front of the terrace. The crucibles containing the materials are introduced at the opening in the summit of the furnace, and placed in a circle on the platform. This opening is then closed with the flat stone, and the air is excluded by covering the stone with moist clay. The small hole in the stone is, however, left open. The fire-place is then filled with wood, and the fire is managed according to the nature of the materials which the crucibles contain.

For making green glass take of the following articles according to apothecary's weight:—

	lb.	*oz.*	*dr.*	*scr.*	*gr.*
Broken glass	14	9	0	0	0
Banaji Callu, powdered white quartz	14	9	0	0	0
Loha (an old button, like brass, was given to me as a specimen)	0	3	2	1	13
Copper	0	2	9	1	16
Cariculla, iron ore with manganese	0	2	1	2	2
Soula, or impure soda	29	6	0	0	0
	58	11	5	2	11

This is the charge for one crucible.

In making red glass the *loha* is left out. Forty-four crucibles stand in one furnace. A small quantity of the materials is assayed in the furnace used for blowing the glass,* and if the soda prevails too much, an addition is made to the quartz.

In order to vitrify these materials, burn on the first day ten bundles of firewood. Next day put out the fire by stopping the access of air to the furnace. Next day put in fresh wood and keep up the fire for eight days; but no supply of fuel is given at night. The fire of course goes out towards morning. Afterwards the fire must be kept up night and day, till the glass be melted; which is known by putting an iron rod into the crucibles through the small hole in the flat stone. This requires from four to six days more. The fire at first is put out with a view of preventing, by this means, the glass from being injured, by the smoke: but it is not easy to conceive any chemical operation more injudiciously conducted than this is. The alkali is never saturated, and effloresces from the glass when that is kept any length of time. Each crucible ought to produce forty-one pounds, three ounces, four drachms, two scruples, and eight quarters of glass, worth seven sultany fanams, or four shillings and eight pence half penny.

The contents of one crucible for black glass are:—

	lb.	*oz.*	*drs.*
Quartz	14	9	0
Soda	29	6	0
Broken glass	22	1	4
	66	4	4

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* Figures of both these furnaces will be given in the sequel to these extracts.

In eight or nine days this is vitrified by a fire burning constantly, and produces about forty-four pounds and a half, worth four and a half fanams, or a little more than three shillings.

The ornamental rings are made as follows:—a circular cavity, about two feet and a half in diameter, is dug in the floor of the workshop, and is covered by a flat dome of baked clay. In this are four perforations around its lower edge. By one of these, the fuel, which is charcoal, is introduced down an inclined plane leading to it. The three other openings are for the workmen to take out the glass, which is put into a flat earthen crucible, formed like a soup-plate, and supported by a bracket, or shelf, of baked clay. When the glass is melted, two workmen sit down at each of the three openings, six men in all, to each furnace, with an assistant to keep up the fire. One man of each pair introduces the point of an iron rod, and turns it round among the melted glass till a sufficient quantity adheres to it. He then takes out the rod, and with one hand gives it a quick rotatory motion on a stone that is placed before him. With the other hand he applies a knife, and forms the glass into a ring, round the point of the rod. He then pushes the ring into the furnace, and there gives it a quick rotatory motion, so that the liquid glass, by the centrifugal force, assumes an elliptic form. The rod is then withdrawn, and the ring is dilated by inserting the point of the knife between it and the rod. It is then pushed on to the point of a cone managed by the other workman, who also gives his cone a rotatory motion, and pushes up the ring upon it, till it becomes of a proper size. He then polishes it, while it is cooling, by applying his knife to the surface, all the while continuing the rotatory motion. The work is carried on with considerable dexterity, and the two men make about ten rings in a minute.

These rings are universally worn by the women of the Decan as an ornament to the wrists, and their applying closely to the arm is considered as a mark of delicacy and beauty; for they must, of course, be passed over the hand. In doing this, a girl seldom escapes without drawing blood, and rubbing part of the skin from her hands; and as every well-dressed girl has a number of rings on each arm, and as these are frequently breaking, the poor creatures suffer much from their love of admiration; but in the female breast this is a more powerful motive than the dread of any common pain.

The soda, or fossil alkali, is found in the soil near Madura, and at Gutalu, a town east from Mundium. In the hot season the glass-makers go to these places and prepare as much as they want. They collect the soulu munnu, or saline earth, into heaps, and near these dig three pits, which I shall call A, B, C. The pit A, in the centre, is a square of four cubits in extent, and one foot in depth. The pit B, is circular, three and a half cubits in diameter, and two and a half in depth. The pit C, is a small circular cavity, capable of containing four or five pots of water, and communicates with the pit A by means of a small channel, which can be occasionally shut up with clay. When all things are ready, the pit B is filled nearly with soulu munnu, and then is added a little water, which is mixed well with the saline earth, so as to form a thin mud. This is then put into the pit A for two hours, when the earth subsides and leaves a clear water impregnated with alkali, which is allowed to run off into the pit c. Some of this water is then put into a fourth pit, and mixed with cow-dung. The mixture is allowed to putrify for three days, and is then spread on forty mats, by means of the twig of a tree, which retains its leaves. When dry, this forms a very thin crust on the mats, which are then laid on the ground and exposed to the sun. Every day afterwards these mats are sprinkled with fifty pots of the clear brine from the pit c, procured as above-mentioned. This is continued for twenty days, when a cake of soda about half an inch in thickness, is formed all over the mats. It is very impure, and sells for two paissas the cucha seer, thirteen shillings and nine pence farthing, the hundred weight. It is used for washing, and for making glass. Large quantities of it are said to be brought from Ellandura, a town about forty miles east from Mysore.

On the Manufacture of Iron and Steel in India: from "A Journey from Madras, through the countries of Mysore, Canara, and Malabar." *By* Francis Buchanan, M. D.

Of the Iron Ore.—At Ghettipura I not only found the ore in several places, but also the pits from which the people were then actually taking it to supply their furnaces. I am at a loss for the desire of concealment relative to minerals amongst the natives, which also extends to every kind of quarry throughout the country, and which equally pervades the officers of government and the other inhabitants. Men who have given me, apparently, correct information relative to their farms, have eagerly denied a knowledge of the fossil kingdom, which they no doubt possessed, and for which denial I can assign no plausible motive. The late sultan (Tippoo Saib,) indeed, is said to have harassed his subjects exceedingly, by making them work at quarries, and also to have been very severe on the smelters of iron; and the people may have suspected that my inquiries might lead to similar oppressions; but, according to the iron-smelters' own account, the sultan gave them a high price for their iron, and by his great demand afforded them constant employment. It is probable, however, that he compelled them to work much harder than they were inclined to do, and that they were defrauded by those who were entrusted with the payment.

Much steel was formerly made at Ghettipura, from whence it derives its name, which signifies, literally, *hard town*. It is a small village, near Sevendroog. Near it are many cultivated fields, intermixed with low rocky hills. The ore is found both in the fields and hills.

The iron ore of the fields consists of small irregular masses, separated by thin layers of earthy matter, and is found in beds, that are from five to ten feet deep, which have only been wrought in a few places, when they come so near to the surface, that they have been discovered by the plough. It is probable, that by digging deep, they might be found to be of great extent. The small masses are easily beaten into powder, and then the black sand is readily separated, by washing, from the clay and sand that are the other ingredients in their composition. This ore is of two kinds; one efflorescing into red ochre, the other into yellow. Intermixed with both these kinds of ore, which are called female stones, are many lumps of what the natives call male stones. It appears to me to be composed of the same materials with the female stone, but is so hard, that the imperfect manipulations of the natives cannot reduce it to a powder, and of course they cannot separate the earthy matter. It is therefore looked upon as useless, fluxes being entirely unknown to the miners of Mysore. The female stone appears to me to be the male in a state of decay.

The iron ore of the hills is also male and female, the latter being the only one used; and this is also, in my opinion, the male in a state of dissolution (decomposition.) The male stone in the hills bears a much larger proportion to the female, than it does in the fields. This ore is also found in digging a very little depth into the soil, and seems to be the source from whence most of the black sand of the country is washed by the rain.

The female stone is very easily reduced to powder, and the iron-sand is readily separated, by washing, from the quartzose-sand, which is the other ingredient in the ore. It is not so rich in metal as the ores found in the fields. These two ores are called *Aduru Cullu*, or stones containing iron-sand.

On the surface of the hills is found another iron-ore, called *Ipanada*, which is scattered among the gravel in small lumps, from the size of an egg downwards. They are a pure ore, and are put in the furnace without any preparation, except breaking the larger pieces into bits about the size of a filbert. The quantity of *Ipanada* required for one furnace is exactly the same, by measure, as that of *Adura;* but the weight of *Ipanada* is of course less, there being more space occupied by interstices, from the greater size of the pieces. The produce in iron from both is the same. The surface of the lumps of Ipanada is often covered with a kind of black enamel.

During the four months of heavy rains, four men are also able to collect as much sand in the channels of the torrents, as a furnace can smelt in the remainder of the year. In order to separate the earth and sand from the ore, it requires to be washed. These men get ten *harams*, or six shillings and eight pence half-penny, a month, and the nature of their service is similar to that of the farmers' servants, being bound by occasional advances of money to continue in the employment of their master. During the remaining eight months of the year they work at the forge.

The smelting furnace is made in the front of a square mound of clay, sloping up gradually from behind forwards.* In the front the mound is twenty-two inches high, and three feet broad. In this mound, from top to bottom, is made a semi-cylindrical cavity, about a foot in diameter. On the ground, in front of the cavity, is laid a square hearthstone, six inches thick, a foot long, and a foot broad. Contiguous to this is placed another stone upright, a foot square, and two inches thick. On the top of this last stone is fixed a small piece of timber, having a hole in it, through which the nozles of the bellows pass, and behind which rises another mound of clay, sloping upwards gradually, and widening as it recedes from the furnace; on this mound rest the two pairs of bellows. Each pair of bellows consists of a whole buffalo's hide, removed from the carcase of the animal without cutting it lengthwise. Where it has been cut at the neck, it is sewn up, so as to leave a small opening for a wooden nozle, which is made fast to the piece of timber before-mentioned. The hinder part of the skin is slit vertically, and the one side or flap is made to lie over the other, two slips of bamboo-cane being stitched, one to each flap, to open or close them by. In the middle of the outer end of the bellows is fastened a ring of leather, through which the workman passes his arm, and seizes the ends of the bamboo slips, which serve as handles. When he draws back his arm he suffers the slips to extend, and the opening in the hinder part of the skin is dilated, and admits the air; when he forces his arm forwards and downwards, the opening is closed up, and the air is forced forwards through the nozle of the bellows. The lower part of the bellows is retained in its place by a rope fastened to its lower angle, and supported by an elastic piece of timber, which is fastened to one of the posts of the hut, like the pole of a turner's lathe. The nozles of both the bellows are inserted in one common tube, which is made of baked clay, and is placed in a sloping direction, so as to pass through a mass of moist clay, that occupies the front of the furnace above the first-mentioned stone or hearth. Above this is placed a large tile; and the empty spaces between this and the first-mentioned mound are filled up with moist clay. The furnace is now made cylindrical, and open at top, on which is placed a chimney, made of baked clay, in the form of two truncated cones joined together by the apices. Of these, the upper cone, or hopper-shaped mouth, is by far the shortest. From this description, it must be perceived that the whole lower front of the furnace is moveable, and when it has been newly built up, a little charcoal is burned in it for an hour, to dry the moist clay by which the various parts are connected. The rents formed during this operation must be carefully closed with more clay, and the furnace is then ready for immediate use.

For smelting the black sand, the following is the process. A quantity of the sand is measured out, and divided into three parts, each of which I found to weigh a little more than twenty-five pounds eleven ounces, avoirdupois. Three baskets of charcoal are then set aside, of which each contains about a bushel. Two of the baskets of charcoal are then put into the furnace at the top of its chimney, and above these one-third part of the sand. The fire is then kindled, and urged with the bellows. When the fire subsides, one half of the remaining charcoal, and another third of the sand, are put in; and when these have again subsided, the remainder of the sand and charcoal is added, and the fire is urged six hours and a half from the commencement. The front of the furnace is then broken, and on removing the walls, a mass of iron is found at the bottom, which is taken out with tongs, and cut into blocks, each weighing half a maund, or a little more than twelve pounds two ounces. By this it would appear that the ore produces no more than about thirty-one and a half per cent.; and the iron so produced, although malleable at first, is exceedingly impure. Tippoo took it from the workmen at three fanams a maund, or nine shillings and three pence half-penny a hundred weight. He gave them, however, great employment, as he made his shot of this iron, by hammering, for the fusion is never so complete as to allow it to be cast in moulds.

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* Figures of this and other furnaces will be given in the sequel of this article.

In order to render this iron more pure, and to fit it for being wrought up into the implements of husbandry, it is taken to another house, and repeatedly forged. There are here also two pairs of bellows, but they are smaller than those in the smelting-house; and the mound on which they are supported being low, a pit is formed behind it, in which the labourers stand, in order to place them on a proper level for their work. The nozles of the bellows are inserted into an earthen tube, which conveys the air into the furnace through one of its side walls. These walls are two masses of clay, one cubit long, ten inches high, and four inches thick; and are placed on the floor, parallel to each other, at the distance of a foot. On them is laid a flat cover made of baked clay, and about an inch and a half in thickness. In its hinder part is an oblong opening, sufficient to admit one of the blocks of iron. The fore part of the furnace is secured on the top by a moulding of clay, which is somewhat ornamented. Before it is placed a stone, a cubit long, twelve inches broad, and three high. Except what is shut up by this stone, all the fore part of the furnace is open. The hinder part is entirely shut up with clay, except a small opening, by which the ashes and vitrified scoriæ fall into the ash-pit.

A block of iron from the smelting-house having been put into the centre of the furnace, it is filled with bamboo charcoal, and strongly heated; while another block is put into the upper opening, to receive some heat as a preparation. When the first block is properly heated, it is placed on an anvil, and receives a few strokes of large hammers from three workmen, who stand in three sunk cavities, formed around the anvil, to reduce them to a proper level, and who thus knock off some ill smelted portion of it, and much of the adhering scoriæ. With a kind of hatchet (chisel) the block is then cut into three wedges, and in this operation the workmen show much dexterity. The second piece is then put into the centre of the furnace, and a third piece is placed in the upper opening of the furnace; while these are heating, the three wedges are again made red hot, and well beaten on an anvil by the three workmen with large hammers. In this state the six wedges produced from one smelting, weigh twenty-four seers, or a little more than fourteen pounds and a half, avoirdupois, and are sold to the blacksmiths, who are, however, obliged to heat and beat the iron three or four times before it is fit for making the implements of husbandry. The weight of the six wedges is then reduced to fifteen seers, a little more than nine pounds; and they sell it at from two to three fanams, or from about one shilling and four pence, to two shillings; that is, from about sixteen shillings and six pence, to twenty-four shillings and nine pence a hundred weight. From this it appears, that the good malleable iron, produced by this means, is not quite 12 per cent. of the weight of the ore.

[TO BE CONTINUED.]

On Improvements in Turret Clocks. *By Mr.* W. WYNN.

[From vol. xlv. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.]

Dean-street, Soho-square, London, April 17, 1827.

SIR,—As I conceive that the Society of Arts will feel as much pleasure to hear of, as I have to relate, the success of the application of those improvements for which they have honoured me with their rewards, I beg to hand you a rate of going of a church clock which I have lately made and fixed in the splendid old church of Boston, Lincolnshire, in which, among many other improvements, I have introduced the escapement for which they awarded me their gold Isis medal, and twenty guineas, in 1817.

Rate of variation from

1826.—Nov. 16 to Nov. 20,	+17″,	being 4 days,	at +6″·75	per day.
20 to 26,	+35″,	being 6 days,	at +5″·83	per day.
26 to Dec. 2,	+43″½,	being 6 days,	at +7″·25	per day.
Dec. 2 to 3,	+ 7″,	being 1 day,	at +7″	per day.

During the above series I was with the clock, having other work to execute in the town, and continually had to be opening the case to show the machinery; yet, notwithstanding this frequent disturbance, the daily error of the above rate was only 7″·25—5″·83—1″·42, or less than a second and a half per day. The pendulum has since been altered, to correct the gaining, and the following has since been the rate of the clock:

Rates of variation from

1827.—Jan. 30 to Feb. 3,	— 1″,	being 4 days,	at —0″·25	per day.
Feb. 3 to 22,	—13″,	being 19 days,	at —0″·614	per day.
22 to Mar. 5,	+ 2″,	being 11 days,	at +0″·18	per day.
Mar. 5 to 22,	+ 1″,	being 17 days,	at +0″·06	per day.

In this last series of fifty-one days, the daily error has, therefore, been 0″·684—0″·18 — 0″·864, or very little more than three quarters of a second.

The accuracy of this rate has prevented the necessity of altering the time of the clock since it was first put going from regulation, and will do so for a long time to come, which is an object of much importance; for an alteration in a public clock, although it be made to correct it, is liable to mislead those persons who are guided by it.

So much is the friction taken off in this piece of work, that the watch part, which goes eight days, whose great wheel is fifteen inches diameter, is keeping up a motion of a two seconds' pendulum, weighing 132 lbs. with maintaining power of 15 lbs. 9 oz. which is not more than a tenth of the weight usually employed in clocks of these dimensions. And I wish to add, that it does not only keep it going, but that it goes well; for the length of the chord of the arc of vibration is twenty-four inches, while that of the angle of escapement is only 9·6 inches. This reduction of the weight of the maintaining power has not only tended to produce the accuracy of rate, but it will be the means of greatly prolonging the duration of the watch part.

I am also much gratified to state that the hammers for which the Society honoured me with another reward of twenty guineas in 1822, most fully answer my expectations. I have attached a set of them to the clock in question, the powers of which are so ample, that they produce sounds from the bells sufficiently loud to be heard in every house in the large town of Boston, which contains twelve thousand inhabitants, an object which was never accomplished before by any eight-day clock. I have also, by the application of my toothed sectors, as described in your 40th volume, and by executing the trains on genuine geometrical principles, been able to lift these hammers with weights from fifty to seventy per cent. lighter than is applied to several specimens of work executed by my contemporaries, as compared with the momenta of the hammers and of the weights severally applied—an object of great importance, as it is generally acknowledged, that to be enabled to lift the hammers of an eight-day clock sufficiently heavy to bring out the tones of the large bells of a church, it would be necessary to employ such heavy weights as to risk the crushing of the machinery in a few years.

I beg to say that the above is a statement of facts which may be most unequivocally authenticated.

I am, sir, &c. &c.

W. Wynn.

A. Aikin, Esq., *Secretary, &c. &c.*

On a machine for opening Horn, for the use of Lanthorn-Makers, Comb-Makers, Cutlers, &c. By Mr. J. James.

Horn is prepared for the use of lanthorn-makers, comb-makers, the cutler, &c. by making it into flat laminæ of various thicknesses, according to the use for which it is intended. The horns are first cut transversely into pieces, according to the use to which each is applicable. The pieces are then slit longitudinally, and are held separately over a naked fire, till heated to the degree at which horn becomes soft; they are then hammered flat by a mallet, and placed in a strong press till they become cold.

Mr. James, who is himself a worker in horn, objects to softening it over a naked fire, in consequence of its frequently being scorched or frizzled, more especially as in opening the old hard horns it is necessary to allow the flame to enter the hollow, that the inside may be rendered equally soft as the outside.

The apparatus employed by Mr. James is a block of cast iron, with a conical hole quite through it, and a plug of the same metal, about one-eighth of an inch less in diameter than the hole. The block and plug are both to be heated in a common fire, or in a stove, to about the temperature of melting lead; the block is then taken out and placed on a firm support, a piece of horn previously slit is put into the hole, and the heated plug is dropped within the horn. This latter, being heated both from within and from without, soon becomes soft; the plug is then carefully and gradually driven in by a mallet, and by its pressure soon redresses any original crookedness of the horn. After being left for about a minute in this state, the plug is to be driven out by turning the block on one side, and the horn being then withdrawn will be found quite soft enough to be opened and pressed in the usual manner. Considerable saving of time is thus obtained, and all risk of overheating the horn is avoided. [*Ib.*

On the Dams and Sluices of the Saymbrumbacum Tank, near Madras. By Francis Buchanan, M. D.

[From a Journey from Madras, through the countries of Mysore, &c.]

In the afternoon of the 23d April, 1800, I set out from Madras, in the very hot dry weather, which usually prevails at this season. After leaving the plain occupied by the houses of the Europeans, I entered a country then scorched up by a powerful sun, yet containing little waste land; for the soil, being fine, produces a very good crop of rice, provided, in the wet seasons, the usual quantity of rain falls. In some places, the industry of the natives causes a verdure that is highly refreshing, by watering a few fields that are near tanks or reservoirs of water. These fields are now covered with rice, approaching to maturity; and in the rainy season they will yield another crop.

Leaving on the right the road to *Poonamalee*, I went to *Condaturu*, near which the country assumes a very different and a very pleasing aspect. Numerous small canals from the *Saymbrumbacum* tank, convey a constant supply of water to most of the neighbouring fields, and fertilize them without the trouble of machinery. They consequently yield every year two crops of rice. The one at present on the ground will be reaped in June, and has a very promising appearance.

24th April.—I set out early, and soon arrived at *Saymbrumbacum* tank, which is of great extent. It has not been formed by digging, like those in Bengal, but by shutting up, with an artificial bank, an opening between two natural ridges of ground. The sheet of water is said to be seven or eight miles in length, and three in width; and in the dry season is let out in small streams, as wanted for cultivation. In the rainy season it receives a supply of water from the river *Chir-nadi*, and from several small streams that are collected by a canal. As at times the water overflows, and would break down the bank by falling over it, and sapping its foundation, the natives, in different places, construct what they call *codies*, or sluices (weirs) of stone. These are twenty or thirty feet wide, and are lower by some feet than the other parts. On the surface they are strongly fortified by large stones placed in a sloping direction; so that the water rushes over without undermining the bank, and is conveyed away from the fields by a canal. This is a matter of the utmost importance; for there are instances where the banks of these large tanks having given way, whole villages have been destroyed by the torrent. In order, however, that when there is plenty of rain, the tank may be completely filled, a row of stone pillars is placed on the top of the sluices (weirs;) and on the water rising to a level with their base, a temporary wall is formed of mud, sticks, and straw, placed between the pillars, so as to confine the water till it rises as high as the top of the bank. People watch this night and day, in order to break down the temporary bank, should any additional rain endanger the whole. The water is let out to supply the fields, by a sluice lined with cut stone or bricks, formed through the bank, on a level with the country. The inner end of this sluice is covered by a flat stone, in which is cut a conical opening, that can be shut or opened by a conical plug (or valve) affixed to a bamboo staff, and which is secured in its place by passing through holes made in cross guiding-bars, let into two pillars of stone, which rise above the level of the water in the tank. The proper name for a tank of this kind, in the *Tamul* language, is *Eray*. *Saymbrumbacum* tank is said to be sufficient to supply with water the lands of thirty-two villages (should the rains fail) for eighteen months. In these villages, it is said, there are five thousand persons employed in agriculture. In a country liable to famine from want of rain, a reservoir such as this, is of inestimable value.

The late collector, Mr. Place, though he augmented the revenue considerably, yet, by the repairs made on this tank during his administration, he gave great satisfaction to the inhabitants.

On the Manufacture of the Cologne Yellow, as a substitute for the Chromate of Lead. By M. BOUTRON-CHARLAND.*

THE discovery of the chromic acid is one of the finest which chemistry has made during the last thirty years; but the dearness of this product has for a long time limited its use; and, notwithstanding the various manufactories established for its fabrication, it is still of too high a price to be employed in the production of those paints or colours which should unite a facility of laying them on the work, with a solidity of colour.

This new product possesses these two desirable qualities; it is sold in Paris under the name of *poudre de Cologne;* after many essays, it is found that 10 grammes of this substance contain 1,95 of sulphate of lead, 6 of sulphate of lime (gypsum,) and 2,5 of chromate of lead, composed of 1,63 of lead, and 587 of the chromic acid. By the analysis, it could not be ascertained whether this powder was formed by a simple mixture of its component parts, or whether it was a true combination.

After examining this powder with considerable attention, the idea occurred to the author of this article, that the sulphate of lime which it contained in such large proportion, was only impregnated with a small quantity of chromate of lead. In making an experiment, he effected the decomposition of the sulphate of lime and chromate of lead, by a solution of sulphate of soda (Glauber's salt,) and the neutral acetate of lead, and a precipitate was instantly formed of a very fine colour, and which only differed from the yellow powder of Cologne by its lesser density. This difference in the weight induced the author to mix the sulphate of lime, in the state of a very fine powder, with a solution of chromate of potash, and precipitate it by means of the neutral acetate of lead, and he thus formed an exactly similar product. The powder obtained by this last process differed in no respect from the Cologne yellow.

On the Manufacture of Marbles in Germany.†

THESE well known articles are made in great quantities to serve in the games of children; some are formed of potter's clay, covered with a glaze and burnt in a proper furnace; others are made of marble and alabaster, but chiefly of a species of very hard calcareous stone, found in the neighbourhood of Cobourg, in Saxony. These stones are first broken into square blocks by means of a hammer, and are finally rounded into spheres or small balls by a mill. In order to this, they are placed from one hundred to a hundred and fifty at a time, upon a fixed slab of stone, having a number of concentric circular grooves or furrows made in its flat surface. Above this stone another flat slab or block of oak of the same diameter, is supported by means of a lever, and turned round by the power of the mill. During the rotary action of this mill, small threads of water are made to enter each of the concentric grooves, which favour the rounding and polishing of the balls, and prevent the wood from heating. The operation for each of the quantities above mentioned, lasts for a quarter of an hour, and the balls or marbles become perfectly spherical and fit for sale. Immense quantities of them are exported to India and China. A mill with three turning blocks will manufacture 60,000 marbles a week.

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* From the *Jour. de Pharm.* 1827; and re-published in Ferussac's *Bulletin des Sciences Technologiques* for January, 1828. Translated for the Technological Repository.

† From the *Archives des décour. et invent.* 1826; and republished in Ferussac's *Bulletin des Sciences Technologiques*, January, 1828.

ESSAYS ON LITHOGRAPHY.—No. VIII.

On printing from Drawings or Engravings upon Stone.

When a design has been completed, the stone may be *prepared* for producing impressions, as has already been pointed out, and it may then be coated with gum. It may be immediately used to print with, although many lithographers prefer to let the stone remain in this state for about an hour before using it; the gum is then removed, and the stone moistened by means of a piece of soft linen, or a sponge, squeezed so as not to wet the stone too much: the stone must be so fixed that it may not move by the pressure used. The scraper of the press is so adjusted, as to reach within about half an inch of the design, and to pass backward and forward freely, without going beyond the stone. Its edge should be perfectly straight, tolerably sharp, and very smooth. This, as well as the leather upon which it is to work, should be rubbed with lard, to cause it to work smoothly. The leather should be so fixed upon the frame, that it may not touch the stone on any point, excepting when forced down by the action of the scraper; it is therefore kept one or two tenths of an inch above it. This precaution does not apply to the lever press where the leather is not stretched over a frame. The requisite preparations having been made, the stone is inked by means of the roller, the paper which is to receive the impression is placed upon it, and upon this is laid a sheet of sized paper, which may be repeatedly used, until, from becoming soiled, it must be exchanged; the press may then be used, and the succeeding impressions taken in the same way; moistening the stone between each impression. To manage the inking properly, a portion of printing ink must be thinly spread out upon a stone, and by passing the roller over this at every impression, it is regularly extended, and minutely divided, and the proper quantity for use is taken up. The roller is passed over the stone several times, in order to insure the quantity of ink being deposited upon the drawing which is requisite for a good impression. When the ink is rather thin, as that which is used for drawings done with the pen, or pencil, for engravings, and imitations of wood-cuts, it is applied very quickly; five or six turns of the roller being ordinarily sufficient; it, however, may require twenty, thirty, or even forty, to give sufficient ink to a very large crayon drawing. It is not unfrequently necessary, before an impression can be taken, to apply the roller anew to the inking stone, and to moisten the lithographic stone a second time with the sponge, as it dries very quickly.

Some persons are in the habit of removing the drawing, either before or after having taken an impression, by rubbing with a sponge, moistened with spirits of turpentine; but it is best not to follow this practice in crayon drawings, until after taking a number of impressions. When every portion of the drawing has been removed by this means, the sponge must be pressed, and the diluted ink with which the stone is covered, carefully cleaned off. The stone is afterwards washed with another sponge and clean water, when the roller must be passed over it, taking care that the moisture left upon the stone, is only sufficient to prevent the ink from taking upon those parts where there is no drawing. If the stone be too wet, the roller will slip, and the drawing would not take the ink well. If properly managed, the lines of the drawing, which has disappeared, will gradually take the ink, and the stone will then be in fine order for giving good impressions. This proceeding furnishes very neat and brilliant impressions, and if it be not followed, the greasy matter which forms the drawing, after it has been subjected to the process of preparation, is apt to be spread and diffused by the pressure, and to produce wide and irregular lines and spots: the removal of the drawing obviates this evil.

When impressions are to be taken from highly finished crayon-drawings, the roller must not be made to pass over the stone with too much rapidity; in this case the ink would not take well, and some parts of the design might be removed. It is necessary to bear upon the roller with a certain degree of force, and to work it cautiously, especially when the stone is inked for the first impressions. When the design is too much charged with ink, or the stone has become blackened, it must be moistened with a sponge, and the roller used more briskly, in order to take off the superfluous ink.

A greater degree of pressure is necessary upon some parts than upon others, and to pass the roller more frequently, according to the effect which certain parts of the drawing may require, or according as the printing ink is more or less thick.

If, in the course of the printing, lines of the drawing become *sticky*, it may be in a certain degree repaired by taking them off with spirits of turpentine; but this is a method which must be sparingly used, as it soon deteriorates the work. After having thus removed the design, it must be well charged with ink and then covered with gum water; and it should be left in that state for twenty-four hours.

Whenever the business of printing from a stone is suspended, it should be covered with gum, that the ink may not become dry and hard. In order to preserve those stones in a good state, which, after the lapse of a certain time, are intended to be used again, they should be covered, after the last impression is taken, with the *preserving-ink*, (described in vol. 4, p. 267,) and then gummed. Designs might thus be preserved for a great number of years. The preserving ink is to be taken off with spirits of turpentine when it is intended to resume the printing.

Of the corrections to be made upon a stone on which a design has been drawn.

If the stone has not undergone the preparation, it is sufficient to take off the lines or faulty parts lightly with a scraper, and afterwards to make the corrections. The scraper, however, can be used only when the stones are smooth and polished; when they are grained and drawn upon with crayons, it is necessary to regrain the stone, as well as to remove those parts of the design which are incorrect. For this purpose the traces of the crayon may be superficially removed with a sharp instrument, and the grain of the stone sufficiently renewed by picking it, with a sharp pointed instrument; when the drawing may be completed. Should the surface from which it is desired to remove the drawing be considerable, it may be effected by means of pumice-stone, if the stone is to be polished: or if it is to be grained, the part to be corrected may be rubbed with fine sand, by means of a small mullar. This kind of work may be executed even after a number of impressions have been taken from it. The dust which may adhere to the stone, is removed by brushing, and then wiping it with a clean linen, or with spirits of turpentine. The design is now to be renewed, and, when completed, the part should be washed over with diluted acid, by means of a pencil, and then covered with gum-water; after having allowed the stone to remain in this state for a few hours, new impressions may be taken. Spirit of turpentine may also be used, to remove the defective parts of a design which has not yet been printed from. When any part of the design disappears in the printing, it may be restored, either with ink or with the crayon, the stone having been first well cleaned from the gum; before recommencing the printing, it is to be prepared and gummed as usual.

If, after having prepared and printed from a stone with a drawing in the manner of engraving on wood, or with large masses of black and white, it is observed that dark or light spots appear, which it is necessary to destroy, the stone, which has been prepared with aqua fortis, must be scratched, in order that the ink with which it is to be covered, may adhere to it perfectly.

It sometimes happens that the printing ink adheres to some parts of the design, or thickens the lines and forms little soft portions: and it is necessary, in this case, to apply an immediate remedy. Those defective parts are taken off by rubbing, and then washing the stone with a sponge, or with the finger and a little gum-water. When those blotches have disappeared, a pencil charged with very dilute aqua fortis should be passed over the parts; they are then to be again washed with the gum, and the printing resumed; it is best, however, to suspend this operation for several hours, in order that the gum may have time to penetrate the stone.

When a drawing is well transferred, no trace whatever will remain on the autographic paper; if, however, all the parts of a writing or design have not adhered sufficiently to the stone, the defective parts may be supplied or corrected with a pencil or a pen, before the stone is prepared. If the stone has been *prepared*, it must be scraped with a suitable instrument, or polished with pumice-stone; then prepared, gummed, &c.

It is desirable to avoid, as much as possible, all necessity for corrections of every kind; and this may, in general, be done if sufficient care be taken in every part of the work, and in the printing. It is, however, very important to be able to remedy defects with facility, in order to obtain a greater number of good impressions, from the same design. This is the most difficult part of the art, and requires new improvements.

We might have entered into further details upon the subject of lithography, and have spoken of some other modes adopted in the practice of it, had our object been to give a complete treatise upon this art, and if the extent of our paper had permitted us to do so. But the end we had in view, and which we hope we have attained, was to impart some knowledge of the art to those who were ignorant of it, or to render assistance to such as wish to practice, or to attain greater proficiency therein. It is of vast importance that a process so useful, not only to the arts and sciences, but also to social intercourse, and in the progress of knowledge and civilization, should be rapidly brought to that perfection of which it is susceptible.

Whenever this is accomplished, the monopoly of the lithographic art, attempted by all the governments in Europe, excepting that of England, together with the censorship of the press, will be abolished. It is to be hoped that the day is not far distant, when every individual will be able to express his thoughts by means of a lithographic press, as freely as he now can by the aid of a little ink and paper.

N. B. Some of our patrons have asked for information with respect to the presses for printing lithographically from prepared paper, or metallic plates, which for some years have been offered to the public for sale. We cannot recommend this method, which has hitherto proved very defective, but which, nevertheless, deserves the attention of inventors. It would be a great triumph for autography if we could substitute metallic plates for stones, which, until the present time, have alone been successfully used. We hope to be able to make some improvements in the lever press, of which we have given a description in this Journal, and shall gladly hasten to make them known, should a favourable opportunity of doing so present itself.

Remarks by the Editor.—It appears that the regular series of essays in the *Journal des Connoissances Usuelles*, are here brought to a close. The article giving an account of the lever press, above mentioned, we will hereafter insert. The subject of lithography will be occasionally continued by the Editor, who has in his possession the best practical treatises on the art which have appeared in the French language, and which he has imported specially with this view.

On the Causes of Dry Rot in Public and Private Ships, and its Remedy. By JAS. BARRON, ESQ., *of the United States Navy.*

A PAMPHLET under the above title has just been published in Norfolk, by commodore Barron. The subject has been repeatedly noticed in this journal, and from the great increase and extent of the evil proposed to be remedied, demands the utmost attention. We shall make a brief abstract of the former, and give to our readers the whole of the latter part of the pamphlet.

The dry rot is attributed to the influence of foul air extricated from the bilge water; and the remedy proposed is the free supply of wholesome air, by constructing the vessels in such a way that it may have free access to the timbers. The deleterious effect of foul air upon vegetable bodies, is viewed as analogous to its action upon animals.

"The most positive proofs (says the commodore) of the destruction occasioned to timber by a foul atmosphere, are to be seen in every ship that is found in a decayed state; the best timber connected with the interior, being more or less injured, while that, even of an inferior quality, situated on the exterior, will be found to be comparatively sound.* A particular illustration of this truth is seen also in the excellent preservation in which the cabin furniture and joiners' work of ships, such as birth boards, &c. are found, arising from the free ventilation of those apartments, and their remoteness from the source of the noxious air generated by the bilge water. I would not be understood as ascribing this destructive agency directly to the bilge water itself, for it is well known that those parts of the timbers which are always covered with it, are seldom known to decay, while those immediately above it are most injuriously affected by the noxious air arising from it."

"Every ship or vessel acts, in some degree, as an hydraulic bellows, according to the quantity of water allowed to remain in her after the pumps have sucked; for as this water, by the motion of the vessel, rolls from side to side, the air above it, is by its motion, alternately forced out and drawn in between the timbers."

"It may not be irrelevant here to observe, that the tightness of ships is a fruitful cause of the destructive atmosphere of which I am speaking; for there is not an instance of the sudden decay of a ship that has proved leaky the first three or four years of her running; and this can only be accounted for, by the continual use of her pumps, constantly admitting a quantity of pure water, and again removing it before it can become impregnated with the properties of the wood and the metallic substances, from which it derives its destructive qualities."

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* "Eight years after the frigate United States was launched, I visited her, and found all the materials unconnected with the internal air, (that is, that air between the inside and outside plank) as perfectly sound as they were when I first joined her in '98: I served on board of her for two years, and could readily identify the articles alluded to. At the time I speak of, the United States had undergone one thorough repair and was equally ready for the second."

The ventilation is proposed to be accomplished by bellows constructed like the common smith's bellows, and to be worked by hand; all modes arising from the motion of the vessel having been found altogether uncertain. A pipe leads down from the valve on the under side of the bellows, and is, at the bottom, connected with another pipe passing fore and aft the vessel, and opening by means of short pipes into the spaces between the timbers, these short pipes being made to pass through the limber boards for that purpose.

The commodore has found that the odour from a small quantity of any suitable substance deposited in the hold, may in a few seconds be perceived upon the deck, when the bellows are worked.

Of the Building of Ships.—"In the preceding pages I have intimated, that in order to the beneficial operation of the air-pumps or bellows, and to prevent the secretion of the destructive air, which the machine is intended to extract, ships should undergo a considerable change in their construction.

"I have submitted my ideas on this subject to several of our most celebrated mechanics, all of whom concur with me in the opinion, that a change may be made in the manner of constructing our ships, without the least risk of impairing their strength; for, although there will be a much smaller quantity of materials employed than in those heretofore built, yet, from the combination of these materials, the ships will be stronger than when, as now, loaded with metals and timbers, which rot in a few years. This superabundance of metal and timber occasions ships to swim too deep, and in a great measure destroys the invaluable quality of buoyancy; while the unnecessary precaution of close ceiling ships, with a view of giving to them additional strength, is, I again urge, one of the principal causes of their rapid decay.*

"A very important advantage would accrue to the merchant service, from the proposed change in the construction of ships, whereby a free ventilation would be afforded to the *cargoes*, which, especially when in bulk, or composed of articles making close stowage, are liable to great damage from being over-heated. This evil is almost inseparable from a *tight* ship, which, as before observed, generates a foul air, destructive to every thing that comes in contact with it; and it has been distinctly ascertained, that less injury would be done to cargoes of grain, and other articles stowed in bulk, in leaky than in tight ships; the latter not being so susceptible of ventilation. A great benefit would also result to the *crews*, from the better state of preservation in which the *provisions* of ships would be kept, by this improvement in their ventilation.

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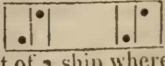
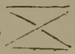
* "In the year 1805, Col. Lear informed me that he visited the frigate *Crescent* in Algiers—she was then about seven years old, and built of the common oak of New England. On examining her, he found that her ceiling had been taken out; and the minister of marine informed him, that to this cause they attributed the duration of their ships."

"Formerly, when ships were built in Virginia, (for the merchant service,) of the common oak of the country, and not so closely connected in their timbers or ceiling as at present, it was not uncommon to see them from sixteen to twenty years old before they had undergone any material repair; but lamentable to relate, we now seldom see a ship, either public or private, that is not more or less rotten in from five to seven years after she is built. The question may then reasonably be asked, what nation can support a navy, if its ships are to be rebuilt in so short a time after their construction?

"Again, if the quantity of timber used in the construction of ships, both public and private, is, under any circumstances, necessary, how are we to account for the latter performing long voyages, through tempestuous oceans, loaded with heavy cargoes, without complaining either by straining or leaking; when, on examination, they are found to be so rotten as scarcely to exhibit one entire sound plank or timber; and, but for the superior quality of the live oak, of which our national ships are principally framed, they would be in the same situation? The fact above stated, of the competency of our private ships to sustain the strain of heavy cargoes, even in the decayed condition represented, certainly goes to prove, that more timber is employed in the construction of our public ships than is necessary for the purposes of strength alone; and regard to the valuable quality of buoyancy, should furnish a strong reason for not lumbering them with superfluous materials. It is an incontrovertible fact, that merchant ships have encountered the heaviest gales while in the condition above stated, without exhibiting the slightest sign of weakness. Public ships, when so loaded with timber, float too deep in the water, either for comfort or fast sailing. The practice too of ceiling the decks over head, for ornament sake, is also ruinous to the beams and deck plank itself, while it so much increases the weight in timber, of which I complain.

"All national vessels should be built with copper bolts, wherever they can be introduced, to be secured by *screw* taps on their inner ends, and removed or replaced at pleasure when a ship is repaired; and by no means should the present practice of cutting out plank and breaking off bolts be allowed; being a great waste of time, and often of valuable materials. If ships were built in the manner here recommended, the strakes of plank might be removed or replaced with convenience, without an additional hole being bored in the frame. It might probably become necessary, in this case, to use bolts one size larger in repairing, as driving out the bolts might somewhat enlarge the hole. I should recommend one bolt in each edge of the plank to pass through each timber composing the frame thus  and not to use tree-nails or spikes at all, in any part of a ship where they can be dispensed with. Thus constructed, ships can be completely ventilated, and when they require repairs, they may be taken asunder with perfect ease, and in a manner to expose every part of their frame to view, by which plan no defect can be concealed or rendered difficult to remove.

"Again, ships should be built in regular frames, coaged or dowelled together, and strongly bolted from the floors to the top timbers.—These frames should be placed from eight to twelve inches apart, (according to the size of the ship;) the ceiling, as far up from the keelson, as one or two strakes above the floor heads, may be flush, and then chamfered pieces, (a term used by carpenters for horizontal pieces of plank) perforated with many small, smooth holes, let in between the timbers—covering the openings between the ceiling and outside plank, to admit the fresh air, as fast as the foul is pumped out by ventilators: the ceiling should then be partial up to the strake below the clamps of the lower gun-deck; using only three strakes of ceiling of from eight to twelve inches wide (according to the size of the ship) over each joining of the timbers. The ceiling should be of plank one-third thicker than that commonly used, and the frame let into it fully that third, thereby forming a kind of jog and chock work, on the principle of a square, supported from the point of each angle thus  which renders the whole frame more secure than a general ceiling in the manner now practised. On each gun deck a strake, or a small part of one, should be left out, and the openings furnished with shutters, hung by hinges, or metal slides, opposite each aperture between the frames, for the purpose of ventilation; to be closed in time of action, or during violent weather. On this plan it is evident ships would be much lighter, contain less timber and other costly materials; would also be sufficiently strong, and show at the first glance that they must be more healthy, as there would be scarcely a place in them where foul air could be secreted.

Of store rooms, &c.—"The whole system of bulk-heads and partitions for store rooms might also be changed for a more open and airy arrangement, all tending to remedy the evil complained of, by admitting a free and unobstructed current of air into every department of the ship, alike promotive of the health of the crews, the preservation of the ships, and of the valuable materials in charge of the store-keepers. Stanchions and shelves would answer all the purpose of dividing the different articles, and one *general store-keeper*, better qualified than those to whom such service has heretofore been assigned, would suffice to supervise the whole distribution of the stores.

On the magazines of ships.—"The magazine of every ship should be as distinct from the hull as convenience will permit. It should form a box, supported on all sides by stanchions, and made perfectly tight, so that in case of fire, it might be overflowed by water, introduced by a pipe passing through the sides of the ship into the box, without connexion with any other part of the ship's hold. An excellent idea has lately been suggested, for guarding against accidents, in conveying powder on board of ships, as well as against the awfully destructive effects of an explosion in the magazine. The plan is this; to have canisters of copper, with screw tops, made water tight, capable of containing from sixteen to twenty rounds of cartridges. Under such circumstances, should a fire occur on board, the magazine might be immediately filled with water, without detriment to the powder; and the ship might burn to the water's edge and fill, before an explosion would be likely to take place. Another highly important advantage of this plan, is the increased effect given to the exertions of the crew, by removing all apprehension of her blowing up; the alarm from which, has on several occasions proved destructive to that discipline, which otherwise might have been effectual in saving the ship.

Of the pumps of ships.—"I cannot but look back with astonishment at the listlessness that has prevailed in the nautical world, for such a length of time, in allowing so great a quantity of water to remain in a ship, after the pumps have sucked. This water, commonly called bilge water, is also a principal cause of a ship's decay, and of the unhealthiness of the crews; notwithstanding which, it is yet the custom to allow, from six inches to two feet of this poisonous water to remain in a ship, under the idea that it would be dangerous to let the pumps have a closer connexion with the seams of the garboard strake, lest they should draw out the oakum from those seams so nearly connected with them. The best reason that could be assigned for not allowing the pumps to descend lower, or to the outer plank of the bottom, commonly called the skin, is that ships are now built much stronger than heretofore, and of course, from the close connexion of the floor timbers, there is not room for the pumps to enter between them; consequently the depth of the floor timbers determines the quantity of bilge water, allowed to remain in a ship. This inconvenience might be removed by having one or more *small* pumps placed farther aft, and let so close down to the inner part of the outward skin, as to take this water up within an inch of the bottom. I will suppose that the close connexion of the floor timbers—or a better reason than the one assigned, namely, that when further removed from any obstruction, the water naturally flows more freely to their heels or entrance—has been the cause of the pumps not being let down nearer to the bottom of a ship. But this reason can have no manner of influence, nor be properly urged as an objection to allowing one or two small pumps to go down within one inch of the bottom, only to be used in drawing this fetid water entirely out of the ship, after those placed at a greater distance from the bottom have sucked, and thereby to extract the last drop of this poisonous cause of death and destruction."

Ships on the stocks, under cover—"One simple suggestion for their better preservation, may not be ill-timed.

"The admission of the external atmosphere in its mildest stages, is, as before intimated, as advantageous to the preservation of timber, as it is generally found to be to that of the human system. Timber of the most superior quality, and in fact every species and quality of wood, exposed to unrestrained currents of the atmosphere, will be rent and split to pieces by the alternate expansion and contraction, thereby occasioned. The proofs of this, are numerous and of daily recurrence. I would therefore recommend that all ships under cover, should be sheltered from the effects of changes in the atmosphere, by causing all the apertures in the ship houses to be as carefully closed as if occupied by families; and opened only when the air is pure and salubrious—for it is an undeniable truth, that timber, exposed to unrestrained currents of the atmosphere, and the vicissitudes of the weather, is rapidly rendered unfit for any useful purpose. Our household furniture affords conclusive evidence of this result; for however perishable its materials, it is seldom seen to be decayed or rent.

"If the foul air in the first instance, and an unrestrained current in the second, are not respectively the causes of the rapid destruction of timber, to what cause is it ascribable, that every species of wood, even of the most inferior kind, is found in a good state of preservation when totally excluded from the influence of either of these destructive agents?"

Observations and Inquiries respecting the alleged Decay of American Timber, in England and Ireland.

The subject to which the subjoined extract of a letter refers, is one of great curiosity, and of deep interest. The letter is from a person of the highest standing for talents and integrity; one whose name alone would bespeak attention to the inquiries made, apart from the importance of the trade dependant upon the productions of our forests.

The Editor had previously heard statements made respecting the rapid decay of certain kinds of American timber, which had been used for architectural purposes in England; these statements he had always considered as greatly exaggerated, if not altogether false; and he viewed, and still views this opinion as justified by the well known fact, that at home, our pine, and other woods, are as durable as the deals from Norway, and the other species of timber imported into England from the north of Europe. The alarming manner in which that species of decay denominated the dry rot appears to have increased in our own day, it was believed would aid in accounting for the complaints alluded to, although the timber of our own, might not be more susceptible of this disease, than that of other countries. We have inquired from gentlemen who have resided in Canada, respecting the durability of the timber of that section of our continent, but have not heard of any fact to lead to the conclusion that their woods used in building, decay more rapidly than those employed by us. Every builder in Philadelphia, we are assured, has seen girders, joists, rafters, and other timber taken from houses which have been pulled down, after standing for nearly a century, which he would prefer to new wood from the mill, because it appeared equally sound, and was perfectly seasoned. The sap (alburnum) of the red deal, of Europe, and of the yellow pine of our country, is, we know, equally subject to the ravages of insects, when cut down at an improper season, and suffered to lie in the woods with the bark on, until they have made a lodgment in the timber.

Should the fact stated below be eventually authenticated, we shall conclude that the English have an insect which has an unfortunate fondness for American food; we hope, however, and believe, that the accounts given will be found to be incorrect; the truth must eventually be ascertained, and the earlier the better; we earnestly desire those who may possess any accurate information upon the subject to communicate it for publication. Is there any insect known which will perforate cork?

Extract of a letter from a distinguished individual in Ireland, dated February, 27, 1828.

"I have lately heard a curious fact respecting some American timber; I believe Canadian pine, but of this I am not certain, as the words used by the person who told me the anecdote were general, viz. American timber.

"A person of our acquaintance had 36 dozen of wine in bottles, packed in Dublin in sawdust of American timber. The sawdust, when the wine was unpacked, was found swarming with an insect which had eaten through the corks of several of the bottles—the wine was spilled, and the bottles filled with the insects; all those of which the corks were yet safe, the person was obliged to have new-bottled. I mentioned this fact to Mr. ———, a great Dublin coach-maker, to whom I had occasion to write at the time, and to whom I thought it might be useful—he answered in these words.

"'I had heard before of the insect you refer to in the sawdust of American timber, and in the timber itself there is a much greater grievance. I understand there are whole streets in London lately built, in which this timber has been used, and rendered almost unfit for habitation by the *cimax* (I believe) *axanthia*, which actually swarms in the crevices of the joints, &c. and cannot be removed by any thing short of conflagration.'"

"I wish you would let me know if there be any complaint of any particular kind of timber in America as being infested with this insect. If the fact be as stated, the *kind of timber* should be distinctly described, for avoidance, else the general report will affect the credit of all American timber. Is there no remedy? Pray inquire, and make your answers more distinct than I have made my questions." E.

AMERICAN PATENTS.

The last number of this journal announced the appointment of the Editor as Superintendent of the Patent Office of the United States. His future residence will, consequently, be the city of Washington. The claims of his official duties, added to the task of a removal, will for a time, interfere with the selections from American patents, which will hereafter occupy many of his pages. He hardly dares to hope that the effect of the plan which he has marked out, will be very apparent until after the lapse of two months. Those first chosen, will, in consequence, be such as will not need the aid of the engraver, but graphic illustrations of the mechanical genius of our countrymen, will, hereafter, be freely given.

'The Repertory of Patent Inventions;' 'The London Journal of Arts and Sciences,' and 'The Register of Arts and Patent Inventions,' published in London, are principally devoted to the patents of Great Britain, whilst the more numerous patented inventions of this country, have remained almost unknown.

When the Franklin Journal was first established, it was intended, among other objects, as may be seen by the prospectus in the first number, to embrace the patents of our own country, and several of them have been published accordingly; but the difficulty of making a proper selection, whilst the Editor resided in Philadelphia, was such as to preclude their frequent appearance; his present station is in this particular most eligible, and his determination is to turn this circumstance to good account. The list of American patents will hereafter appear regularly, so as to embrace, in each number, those obtained in the course of a month.

Description of the mode of heating rooms, invented by Archibald M'Alister *&* John Iggett, *of Ross county, Ohio.* Patented Dec. 15th, 1827.

We the subscribers, do hereby declare that our improvement in the art of warming and heating the various rooms and apartments of houses, is of the character described in the following words, that is to say: A cast or sheet iron stove, of any required size or dimensions, is to be enclosed on the sides, ends, top, and bottom, with marble slabs, either polished or in the rough, or with brick, or other kinds of stone. This covering may be in thickness, from one to any number of inches, though it is believed, that a thickness, of from one to three inches, will best answer the ends for which it is designed; it is not to be in contact with, but at a distance from the stove, of from one to any number of inches, though it is believed, that a distance of from one to three inches will accomplish best the object in view. The several plates on the side, ends, top, and bottom, are to be so made and fitted together, as entirely to enclose the stove, with the exception of the spaces hereinafter mentioned to be left, viz:—The plates around the sides and ends, are not to extend upwards so far as to be in contact with that over the top of the stove, but a space is to be left between the same, of from one to three inches wide, entirely around the stove, and the top plate to rest on marble, brick, or other stone blocks or pillars, standing on the side and end plates—a space is also to be left on the top of the stove, for the pipe to pass through. If the door be in the end of the stove, a space should be left accordingly, in the front plate. The plate in front may be left off entirely, and in that case, the ends of the upper, and under side plates of the stove, are to be connected, by means of marble, stone, brick, or any other durable material, occupying the intermediate spaces; a tube of tin or sheet iron, communicating with the air outside of the house, or at least with that out of the room in which the stove stands, is to pass up through the floor, and through the lower plate of the covering above described. Thus constantly supplying the space between the stove and the casement surrounding it, with fresh air, which, as it strikes the stove and becomes heated, passes in a continual current, through the space left, as above mentioned, around the upper edge of the stove, out into the room where the stove stands. The foundation upon which the stove is to stand, and the pipe accompanying it, may be the same as those of stoves now in use. Instead of leaving a space as above described, between the upper plate and those around the sides, said plates may be made to come in contact with each other, and in that case, a number of holes are to be made, through the upper plate, for the air to pass through; and the upper plates may, if wished, be cast iron, and side holes left in them, at the time they are cast.

For the purpose of burning the Lehigh or other coal, which is difficult of ignition, the stove may be of such a shape, that a lateral or horizontal section of it, may be either circular, square, or oblong, with the door or aperture through which the coal is to be put into the stove, on the upper part of one of the sides or end plates: For the purpose of giving a draft to it, a number of small holes are to be left through the lower edge or corner of the same, and a few also, through the bottom of the stove, through which the air is to pass from without, into the stove. The stove is then to be encased, on all sides, in the manner above described, with marble, brick, or other stone, leaving a space as above mentioned, for the heated air to pass out into the room. A tube, like the one above described, is to accompany it, for the purpose of forcing the air out into the room; and for the purpose of giving an additional draft to the stove, another tube or tubes similar to the first, is to pass up through, and communicate the air to the above mentioned holes, around the lower edge and bottom plate of the stove. The pipe may be placed upon it as with stoves now in use; or if a greater draft is wished, the pipe may pass down into the stove, so that its lower extremity shall reach near to the coal in the stove, and in the latter case, the portion of the pipe passing into the stove, must be of cast iron. To catch the cinders and ashes, falling through the holes in the bottom of this kind of stove, a space is to be left at the bottom of one of the ends or side plates, of two or three inches wide, into which, a sheet iron draw is to be inserted, of dimensions fitted to fill said space.

The principal advantages of stoves thus improved, over all others now in use, are the greatly diminished quantity of fuel which they require, their increased power of throwing out heat, and the greater uniformity of temperature which they produce in the air of the room where they stand. The improvement consists in the application of the above described tubes and casements, to the ordinary stoves now in use, and the principles therefore, which distinguish this improvement, may be applied to stoves of any kind, shape, or dimensions.

Stoves thus constructed, combine, it is believed, all the important advantages of the Russian, and other stoves now in use, with those which peculiarly distinguish the above described improvement superadded to them.

ARCHIBALD M'ALISTER,
JOHN IGGETT.

Specification of two Patents issued to WILLIAM MAGAW, *of Meadville, Pennsylvania, for making Paper of Straw, &c.—the first dated March 8th—the second 22nd May,* 1828.

TAKE any quantity of straw, and boil it in water with salts of ley, pot or pearl ash, in the following proportions. To one hundred and fifteen pounds of straw, add from fifteen to twenty pounds of the salts of ley, and boil it about thirty minutes, then draw off the water, and put the straw into a common paper engine, to be manufactured like rags into paper. WILLIAM MAGAW.

The improvement or discovery consists in preparing straw, hay, or other vegetable substances for the manufacturer of paper in the following manner. Take any quantity of straw, hay, or other vegetable substances, and boil it in a solution of salts of ley, pot, or pearl ash, or other alkali, or lime, in the following proportions, viz. To one hundred and fifteen pounds of straw, hay, or other vegetable substance, add from fifteen to twenty pounds of salts of ley, pot, or pearl ash, or other alkali, or lime, and boil them about thirty minutes, or steep the materials in the solution a few days, or until saturated; then draw off the water, and put them into a common engine, to be manufactured into paper like rags.

The discoverer claims as his exclusive improvement or discovery, the materials, and the mode of preparing the straw, hay, or other vegetable substances, so as to render them fit for the manufacture of paper. WILLIAM MAGAW.

By turning to p. 92, vol. 1, the reader will find that Louis Lambert, of Paris, obtained a patent in England for a process similar to the foregoing, in which it is expressly stated that "the straw is then boiled with quick lime in water, for the purpose of extracting the colouring matter, and separating its fibres. Castic potash, soda, or ammonia may be employed for this purpose instead of lime."

Specification of the mode of extracting Tannin from Bark. Patented by JOSEPH GILES, *of Guildford, Vermont.* April 11, 1827.

Specification.—This lixivium, or tanning principle, is obtained by soaking and digesting the proper materials, such as fine ground oak, or hemlock bark, &c. in an apparatus designed particularly for the purpose: that is to say, I take twelve leaches or vats, of any convenient capacity, each filled with ground bark, and so placed, as to draw by a cock, with suitable convenience, from each of the twelve leaches into one common receiver; I then place one cistern above the leaches, so as to draw from said cistern, into all the twelve leaches. Into this said upper cistern, I have a common engine for generating steam, operating so as to heat the liquor therein, to a boiling heat; which liquor, thus heated, I draw upon and fill the first of the said twelve leaches. I take care in filling the leaches with ground bark, that it be loose and be not crowded; but so that the liquor will freely fill the whole leach, and become saturated with the tanning principle of the bark; after thus lying upon the bark, and soaking it a convenient time, I draw it from the leach into the receiver; I then pump it from the receiver, back in the cistern, and heat it again with the steam engine, as before; then I draw the liquor upon the second leach, and while it is soaking there, I heat water, or weak liquor, drawn from the leach, after the first process, and draw the same from the cistern upon the first leach; I then draw the strong liquor from the second leach, into the receiver, and from thence, pump it again, into the cistern; I again heat it as before, and then draw it upon the third leach, and so continue the liquor—repeating the process through the whole twelve leaches. following on with the second, and third, and sometimes fourth addition, to the first leach—taking care that none of the weak liquor or subsequent runnings become mixed with the first running and strong lixivium. As often as the tanning principle becomes entirely exhausted from the leach in any of the leaches, throw away the leach, and fill with fresh. By continuing this process, I reduce the entire tanning principle and strength of three, and even four cords of the best bark, into one hogshead of tanning lixivium. I then add two pounds of saltpetre, and one pound of common salt, to each hogshead of my lixivium, and bung it up, air-tight, for use.

One hogshead of this lixivium will, in three days time, sufficiently tan five dozen of calf-skins, and heavy skins and hides, in the same proportion. In addition to the great saving of time, and labour of workmen, produced by the use of this powerful lixivium. the leather will be more completely tanned, will weigh heavier, will be more solid and close, and be less subject to be soaked with water, and grow spongy, than leather tanned in the ordinary manner.

This lixivium, may also be usefully applied to cables, to all sorts of ropes, sails, canvass, and the tackle of ships, made from hemp, or flax: charged and impregnated with this principle, they will support a greater weight, obtain a greater strength, will wear longer and smoother than the common tanned rope or cable. It may be transported to all parts of the United States in a perfect state of preservation, and be at all times ready for use, either for tanning, or other purposes, and thus, supersede the use of bark in the ordinary way.

Joseph Giles.

Specification of an improved mode of impressing figures on the rollers for calico printers, by etching; invented by David H. Mason *and* Matthias W. Baldwin, *of Philadelphia.*

The former method of making these mills was by punches, with figures of rosets, leaves, circles, pins, or other figures. The punches having on them the figure or device required, are driven into the steel cylinders or mill, and the metal raised up by the punch is faced off, and the parts united and trimmed with a graver; or the whole figure or device was cut in with a graver.

The improvement of the petitioners consists in *etching* the device on the mill, which we do in the following manner: A steel cylinder or mill is prepared, of suitable size, with pivots or journals, in the usual manner of making such mills; the mill is then coated with varnish, or etching ground, such as is used by engravers for covering their plates, in etching; the device is then traced through the varnish or etching ground, with an etching needle, or steel point: the device being thus traced, the pivots or journals are coated with a varnish made with asphaltum and spirits of turpentine, so as to prevent the acid from acting on the mill except where the device has been marked through the varnish with the etching needle, or steel point; the mill is then immersed in a prepared acid, in making which, we use the same kind of acid (viz. aqua fortis, or nitrous acid,) which is used for etching on copper; but are careful not to have any copper in it. Our mode of preparing the acid is as follows: we dilute the acid in the proportion of four or five of spring water, to one of acid, and then dissolve in it as much tinfoil, or block tin, as it will take up, or until it ceases to effervesce; while in this operation, it must be in a bottle with the stopper out: this mixture is diluted in the proportion of from eight to fifteen parts of water, to one of the acid used in the first instance, according to the kind of work to be etched. For coarse work, the prepared acid should be strong; and for delicate work, it should be weak. This prepared acid is managed, in all respects, as nitrous acid is managed, by engravers on copper, except that generally, in the prepared acid, there are no bubbles by its action on the steel.

This process may be performed by any of the other preoarations of acid used in biting soft steel; but that above described we found to answer best.

When the mill or steel cylinder, has been in the prepared acid a sufficient length of time, to bite in the figure, or device traced with the etching needle or steel point, to the required depth, (which is ascertained in the usual way, by scraping off the varnish from a part of the device,) it is taken out, the coating of varnish removed, and the figure, or device, is finished with a graver, in the usual manner of finishing etching; the mill is then hardened, and a transfer taken from it to another steel cylinder or mill, so that the figure, or device etched, in the first, shall be raised on the second; in order that it may be impressed on the copper cylinder, to be used in the calico printing; all which transfers are made in the usual manner, and with the usual machinery for affecting such transfers of engravings.

What we claim as our invention, or improvement, is the *etching* of figures, or devices, on steel cylinders or mills, to be transferred to copper rollers for calico printing. We claim nothing more.

In testimony that the above and foregoing is a true specification of our said improvement, as herein before described, we have hereto set our hands and seals, this twelfth day of October, in the year of our Lord eighteen hundred and twenty-seven.

DAVID H. MASON.
MATTHEW W. BALDWIN.

Specification or Description of an improved Gun Lock, for which a patent has been obtained by NATHANIEL SALTONSTALL, JR., *of New London, Conn., prefaced by a few remarks on the defects of those now in use.* Issued May, 1828.

VERY many of the dangers to which we are exposed from the accidental discharge of fire-arms, arises from the present imperfect construction of the lock, the trigger of which, is at all times immediately connected with the dog, and may in many cases be made to trip when only half-cocked, and has been attended with the most fatal consequences to sportsmen, horses, horsemen, soldiers, and private individuals, by the accidental catching of the trigger, the sudden jar of a holster, the pressure of a heavy finger, or the trifling of the inexperienced, when little care was supposed necessary; and with most of our locks the dog must be drawn from the tumbler so suddenly, to prevent their catching at half-cock, as to destroy the aim.

The following description of my improvement, I think, will supply these defects, and combine entire safety with durability and simplicity. When the lock is only half-cocked, the tumbler is secured by a strong steel dog, hung nearly perpendicular from the top of the plate, its screw supported on top by a bridle or cap; on the right hand side of this dog, and falling nearly perpendicular with its centre, is a tooth or wedge, with its point downwards; on a line with the bottom of this tooth or wedge is a lever, which has on the end next the tumbler a tooth or wedge, similar to the one on dog, and an arm projecting on its outside at right angles with the plate; this lever may be of a suitable length, accommodating itself to the size of the lock, and is secured by a screw on its opposite end; between this lever and dog, and operating near the heels of each, lays a double acting spring, forcing the dog into the tumbler, and the lever from the dog; the lever is prevented from falling below the plate by a projection or stop. If the lever is now raised by the trigger, the tooth or wedge passes on the right hand side of the one on dog, and by the combined action of the teeth or wedges, and spring, which is now put in its greatest tension, the lock is more firmly secured together; if the lever is kept raised by the trigger the tumbler is secured, and the cock cannot be moved backward or forward by any external application; the moment the finger releases the trigger the lever returns to its place, and admits of cocking the lock. The upper part of the tumbler is more full than the lower, and the upper notch not so deep as the lower one, consequently, when cocked, the tooth or wedge on dog passes on the right hand side of the corresponding one on lever; if the lever is now raised, its tooth or wedge passes on the left hand side of the corresponding one on dog, and draws it from the tumbler without the possibility of its catching at half-cock, unless eased to its place by the hand. As this description refers to a right hand lock, an inversion of its parts would form one for a left hand barrel. This improvement is not understood to be confined to the situation I have given it in my drawing, but may be applied in various situations round the tumbler, and at convenient distances, and in forms and sizes suiting the fancy; and its effects produced with equal certainty by dropping the lever, if thought more desirable, which may be accomplished by a different disposition of its parts. With this improvement, which is easily applied to old locks by a slight alteration of their tumblers, and removing their dogs and feather springs, or dog springs, and is alike applicable to all gun locks operating by flint and steel or percussion, effectually securing them from springing when only half cocked, and insuring a perfect stroke with the cock when firing, is designed without bruising the dog or tumbler notches.

I claim every mode of operation for engaging and disengaging the trigger from the dog, securing the dog with, and disengaging it from the tumbler, on the principle of inverse application of lever or levers, inclined plane or inclined planes, cone or cones; half circle, or half circles; tooth, or teeth, of any curvature; applied by an arm or lever, as in my drawing, or on the principles of a bolt, or slide, which produces the same results, and may be varied to suit the fancy.

Nathaniel Saltonstall, Jr.

An improvement in the Process of making warm pressed Castor Oil from Castor Beans, invented or discovered by Timothy Pharo, *of Tuckerton, New Jersey.*

Specification.—A kiln built of bricks, about five by six feet square, and four feet six inches high, is to be erected, and to be covered with tin or sheet iron, supported by small iron bars across the top. A wooden frame, from four to six inches deep, is placed on the edges of the top of the kiln, to confine the beans on the tin floor, while warming. A large sized iron stove is to be enclosed in the kiln, with the stove door on a line with one end of the kiln, for the purpose of keeping up the fire, to raise the proper heat. At the opposite end of the kiln, a small iron door is hung, for the purpose of opening and shutting occasionally, to graduate the heat.

When preparing to press the oil from the beans, the beans are to be placed upon the tin or sheet iron floor above described, where, by means of the heat raised by the fire kept up in the stove, the beans are warmed to any degree the manufacturer deems proper, and are thence removed into the iron churn to be pressed with an iron screw, propelled by horse, steam, or water power.

The above described process of procuring the oil from the beans, is new and to be preferred; because,

1st. The beans are more expeditiously warmed, and saves the expense of the labour of one hand.

2nd. All danger of scorching them is avoided, and thereby the oil is saved from any disagreeable taste, and procured in the utmost purity.

3d. The beans can be properly warmed and dried for pressing, even when in a damp state, which cannot be done by a cylinder.

Timothy Pharo.

ENGLISH PATENTS.

List of Patents for New Inventions, which passed the Great Seal in England, in January, 1828.

To William Gossage, chemist; for his having invented, or found out, certain improvements in the construction of cocks, for the passage of fluids—Sealed, January 2.

To Thomas Botfield, coal and iron master; for his invention of certain improvements in making iron, or in the method or methods of smelting and making of iron—January 2.

To James Hall, junr., dyer; for his invention of certain improvements in dying piece goods by machinery—January 2.

To Joseph Clisild Daniell, clothier; for his invention of certain improvements in dressing cloths, and in the machinery applicable for that purpose—January 2.

To William Morley, lace manufacturer; for his having invented or found out, certain improvements in, and additions to, certain machines or machinery now in use for making lace, or net, commonly called bobbin or twist net lace—January 9.

To James Andrew Hunt Grubbe, clerk; for his having invented a transmitting heat wall, for the ripening of fruit—January 9.

To James Gilbertson, grocer; for his having invented an improvement, or improvements in the construction of furnaces, by which they consume their own smoke—January 15.

To Charles Hooper, shear-grinder; for his having invented a new, valuable, useful, and improved machine for shearing, and cropping woollen and other cloths—January 15.

To John Evans, the younger, paper maker; for his having invented certain improvements on steam engines—January 15.

To Joseph Blades, gentleman; in consequence of a communication made to him by a certain foreigner residing abroad, for his new invented improvements in the water-proof stiffening for hats—January 15.

To William Newton, civil-engineer, and mechanical draftsman; in consequence of a communication made to him by a foreigner residing abroad, for an improved surgical chair-bed, with various appendages, designed for useful purposes—January 15.

To George Daniel Harris, clothier; for his having invented or discovered, certain improvements in dressing and preparing woollen yarns, and in cleansing, dressing, and finishing woollen cloths, and other fabrics, and in the apparatus for performing the same—January 15.

To James Falconer Atlee, gentleman; for his invention of certain improvements on bands, or hoops, for securing made and other masts, bowsprits, and yards, and applicable to other purposes—January 15.

To William Erskine Cochrane, esq., for his new invented improvements in certain apparatus for cooling, and other purposes—January 15.

To Joshua Taylor Beale, engineer, and George Richardson Porter, merchant; for their new invented mode of communicating heat for various purposes—January 19.

To William Percival, veterinary surgeon; for his new invented improvements in the construction and application of shoes without nails to the feet of horses, and certain other animals—January 19.

To George Jackson, attorney-at-law, for his invention of certain improvements in machinery for propelling boats and other vessels, which improvements are also applicable to water-wheels and other purposes—January 19.

The list of American Patents is unavoidably omitted, for want of room.

INDEX.

PAGE
ACADEMY, Rumford premium of the American, 233
Active and passive strength, 124. 193. 230. 296
Account of the Island of Ceylon, 328
Air engine, *patent*, 314
Air, attempt to navigate it by means of kites, 93
Air, on the density of, under Niagara Falls, 48
American canvass patent, 59
American patents, list of, 62. 137. 210. 284. 256
Animal strength, 109
Animadversions, Genet's remarks on the Editor's, 51
Apparatus, for evaporation and distillation, 1
——— for distillation, *patent*, 10
——— for gas, *patent*, 13
——— Barton's, for lubricating gudgeons, 209
——— for a diving, *patent*, 306
——— for distillation in vacuo, (Tritton's,) 332
——— for bladder distilling, 334
——— for drying mildewed grain, (Hebert's,) 336
——— for filtering, in closed vessels, Donavan's, 373
Azimuth compass, 266

Bakewell, on loss of power, 344
Barometer, Espy on the cause of the diurnal variations of the, 278
Barton's method of ornamenting steel, 99
——— apparatus for lubricating gudgeons, 209
Bells, history of, 107
Bistre, and indelible ink, Mac Culloch on, 181
——— preparation of, 185
Blackman's oil colour cakes, 180
Blacking and polishing leather, compositions for, 160
Blast blowing, by a fall of water, Lewis on, 236. 299. 378
Bladder distilling apparatus, 334

PAGE
Bleaching, Lac, Field's and Lanning's method of, 270
——— and washing, *patent*, 303
——— powder, 318. 375
Blowing furnaces by a fall of water, Lewis on, 189. 236. 299. 378
Blower, Editor on an economical, 208
Bluing steel, 130
Blue colour, Braconnot, on a beautiful, 98
Bookbinders, rolling press, 389
Books, gilding on edges and covers of, 35
Braconnot, on a beautifull blue colour, 98
Bricks, for improvement in making, *patent*, 363
Bridge, suspension, 217
Brogniart, on colours for porcelain, 80
Brown's letter on Mr. Perkins's remarks, 206
Bull's defence of his experiments on fuel, notice of, 273

Cakes, Blackman's oil colour, 180
Calcining, roasting, and smelting ores, *patent*, 177
Cameron's method of making cheap soda liquor, 388
Canvass, patent Phenix Mill, 58
Cards, for enamelling, *patent*, 313
Carriage ways, paving for, *patent*, 179
Carriages, Editor on propelling by steam, 185
——— steam, 187
——— ——— Burstall and Hill, *patent*, 248
——— to be drawn by kites, do. 251
——— step, for a selfopening, do. 258
Carey's method of coppering ships, 292
——— fastening ships with iron knees, 293
Carding and scribbling, improvement in, *patent* 257
Castor Oil, pressing, *patent*, 421
Casting and grinding speculums, Edwards on, 40, 76. 148
Casks, Dickenson's metal, *patent*, 362
Cat-block, *patent*, 263

PAGE.
Cements, on various, - - 112
Cements and lutes, Deville on, - 181
———water-tight, for furnaces, 120
——— Gill on the parolic, or universal, - - - - - 203
——— for ships' bottoms, - 277
Centrifugal check-hooks, for mines, Speer's, - - - - - 281
——— Leay's improvement on the, - - - - - 282
Ceylon, account of the Island of, 328
Chloride of lime, or bleaching powder, - - - - - 318. 375
Clock and watch making, history of, - - - - 151. 245. 294
——— dials, illuminated, - 390
Closed vessels, Donavan's apparatus for filtering in, - - 373
Coach, Skinner's improved safe, 353
Cock, Russel's hydro-pneumatic liquor, - - - - - 361
Cocks and taps, Ridgeway's porcelain, *patent*, - - - - - 367
Coffee urn, Evans's improved, - 387
Colour, Braconnot, on a beautiful blue, - - - - - - 98
——— Wynn, on preparing and laying on enamel, - 168. 221
Compass, Lindsay's fog azimuth, 266
——— new solar, - - 209
Communicating power from a water wheel, - - - 350
Compositions for blacking and polishing leather, - - - 160
Condensing smoke, &c. Jeffery's method of, *patent*, - - 368
Coppering ships, Carey's method of, 292
Copperplate impressions in plaster of Paris, - - - - - 207
Crayons, French mode of making red, - - - - - - 157
Curadau and Saliman's still, - 339
Dansey, capt., on a kite for relieving stranded vessels, - - 280
D'Arcet on water gilding, - 33
Density of air under Niagara falls, 48
Descharmes on some properties of iron, - - - - - - 201
Deville, on improved lutes and cements, - - - - - 181
Dials, illuminated clock, - 390
Distillation and evaporation, apparatus for, - - - - - 1
——— in vacuo, Tritton's apparatus for, - - 332
——— apparatus for, *patent*, 10
Distilling, improved mode of, - 7

PAGE.
Distilling apparatus, bladder, - 334
Diurnal variations in the barometer, Espy on the cause of the, - 271
Diving apparatus, *patent*, - 306
Doors, improved hinge for library, *patent*, - - - - - 264
Donavan's apparatus for filtering, in closed vessels, - - 373
Drying mildewed grain, Hebert's apparatus for, - - - 336
Dying hats, *patent*, - - 29
——— nankeen colour, process for, 154

Edge tools, Parkes on the manufacture of, - - - - 198. 226
Edges and covers of books, gilding on, - - - - - - 35
Editor's remarks on gas and vapour engines, - - - - - 18
——— on speculums for telescopes, - - - - - 39
——— animadversions, Genet's remarks on the, - - - 51
——— on propelling carriages by steam, - - - - - 185
——— on an economical blower, 208
Edwards on casting and grinding speculums, - 40. 76. 148
Emery, Hawkins on washing, - 88
Enamel colours, Wynn on preparing and laying on, - 168. 221
Enamelling cards, - - 313
Encaustic painting, - - 100
English patents, list of, 66. 141. 213. - - - - - - 286. 421
——— mode of gilding, - 163. 234
Engine, pneumatic or vacuum, *patent*, - - - - - 20
——— for an air, *do.* - 314
——— vapour *do.* - - 23
Eradicating the stumps of trees, method of, - - - 385
Essays on lithography, No. VI. 267
——— VII. 341
——— VIII.
Etching Printing Rollers, *patent*, 418
Evaporation and distillation, apparatus for, - - - 1
Experiments on timber, and an improved rafter, Smart's, - 220
——— on fuel, notice of Bull's defence of his, - 273
Extracting the fecula from the potato, - - - - - 52

Falls, Niagara, on the density of air under, - - - 48

Fastening ships with iron knees, 293
Fecula from the potato, on extracting the, - - 52. 172
Fog azimuth compass, Lindsay's, 266
Folding ladder, Green's, - 356

FRANKLIN INSTITUTE.

Officers for 1828, - - 73
Quarterly report (sixteenth,) 74
———— (seventeeth,) 352
French patents, list of, 68. 142. 214
——— mode of making red crayons, - - - 157
Fuel, notice of Bull's defence of his experiments on, - - 273
Furnaces by a fall of water, Lewis on blowing, 189. 236. 299. 378

Gall, ox, Tomkin's method of refining, - - - 175
Gasometer, itinerant, *patent*, 317
Gas-apparatus, *do.* - 13
—— obtaining and purifying, *do.* 15
—— and vapour engines, Editor's remarks on, - - 18
—— lamp, self-generating, - 31
—— Pinkus's improvements in illuminating, - - 205
Gates, modes of suspending heavy, 264
Genet's remarks on the Editor's animadversions, - - 51
Gill on the parolic or universal cement, - - - 203
Gilt and silvered wood, method of recovering the metal from, 173
Gilding, D'Arcet on water, - 33
——— English mode of, - 163. 234
——— on iron and steel, &c. 34
——— on edges and covers of books, - - - 35
Glass, origin and history of, - 103
—— on the manufacture of in India, 391
Glasses, manner of polishing and silvering looking, - 145. 241
Graduated nautilus lamp, 374
Grain, Hebert's apparatus for drying mildewed, - - 336
Grecian method of encaustic painting, - - - 100
Grinding and casting speculums, Edwards on, - 40. 76. 148
Gudgeons, Barton's apparatus for lubricating, - - 209
Gun-lock, improved, *patent*, 419

Hall, on the density of air under Niagara falls, - - 48
Hats, dying, of, *patent*, - 92
Hawkins, on washing emery, - 88
Hawkins' hydraulic weighing machine, - - - 336
Heald, or harness, patent, - 30
Heating rooms, *patent*, - 414
Hebert's apparatus for drying mildewed grain, - - 336
Hinge for library doors, improved, 264
History and origin of glass, - 103
——— of bells, - - 107
——— of clock and watch making, &c. - 151. 245. 294
Holes, for stamping fine, *patent*, 256
Horse, a steam, - - 283
Hulling rice, *patent*, - 309. 311
Hydraulic weighing machine, Hawkins's, - - - 336
Hydro-pneumatic liquor cock, Russel's, - - - 362

Illuminating gas, Pinkus's improvements in, - - 205
Improved mode of distilling, - 7
Impressions from seals in wax, mode of taking, - - 204
———— on plaster of Paris, *copper-plate*, - - - 207
———— from medals, &c. method of taking, - - 208
Indelible ink, and bistre, Mac Culloch on, - - 181
Inkstand, *patent*, - - 365
Iron and steel, &c. gilding on, 34
—— improvement in manufacturing, - - - 177
—— Descharmes on some properties of, - - - 201
—— rail-ways, suspension, *patent*, 260
Iron knees, Carey's method of fastening ships with, - 293
Island of Ceylon, account of the, 328
Itinerant gasometer, *patent*, - 317

Jeffery's patent method of condensing smoke, &c. - - 368
Journals, Tyler on levers, and stress on, - - - 57

Kites, attempt to navigate the air by, - - - 93
——— a carriage to be drawn by, 251
——— for relieving stranded vessels, Capt. Dansey on a, - 280
Knees, Carey's method of fastening ships with iron, - 293

Lac, Field and Lanning's methods of bleaching, - - 270
Ladder, Green's folding, 356
Lamp, self generating gas, - 31

Lamp, graduated nautilus, - 374
Lanning and Field's methods of bleaching lac, - - 270
Lathe, Tyler's improved turning, 61
Lead, improvement in manufacturing white, *patent*, - - 366
Leay's improvement on the check-hooks, - - - 282
Leather, compositions for blacking and polishing, - - 160
Levers, and stress of journals, Tyler on, - - - 56
Lewis, on blowing furnaces by a fall of water, - 189. 236. 299. 378
Library doors, improved hinge for, 264
Lime, chloride of, or bleaching powder, - 318. 375
Lindsay's fog azimuth compass, 266
Liqueur still, used in Paris, - 341
Liquor cocks, Russel's hydro-pneumatic, - - - 362
Lithography, No. VI. Essays on, 261
——————— VII. do. 341
——————— VIII. do. 403
Looking glasses, manner of polishing and silvering, - 145. 241
London university, illiberal views on, - - - - 90
Longevity, modern instances of, 136
Loss of power, Bakewell on, - 344
Lubricating gudgeons, Barton's apparatus for, - - - 209
Lutes and cements, Deville on improved, - - - 181

Mac Culloch on an indelible ink, and bistre, - - - 181
Mechanics' Assistant, Townsend's, 60
Medals, method of taking impressions from, - - - 208
——— gilding on, - - 34
Metal from gilt and silvered wood, method of recovering the, - 173
——— casks, Dickenson's patent, 369
Method of coppering ships, Carey's, - - - 292
Mice and rats, on destroying, 162
Mildewed grain, Hebert's apparatus for drying, - - 336
Mines, &c., for raising water from, *patent*, - - - 254
——— Speer's centrifugal check-hooks for, - - 281
Mouldiness, prevention of by perfumes, - - - 96

Nautilus lamp, graduated, - 374
Nankeen colour, process for dying, 151
Navigation of the air by means of kites, - - - 93
Niagara falls, on the density of air under, - - - 48
Notices, 72. 144. 216. 288. 359. 428
Numbers, new mode of squaring, 46

Oil, Seneca, on the use of, - 36
—— colour cakes, Blackman's, 180
Ores, calcining, roasting, and smelting, *patent*, - 177
Ornamenting steel, Barton's method of, - - - 99
Origin and history of glass, - 103
Ox gall, for painters, Tomkins's method of refining, - 175

Paddy, or rice, for cleaning, *patent*, 311
Painting, Grecian method of encaustic, - - - 100
Pans, improved salt, *patent*, 253
Paper of straw, *patent*, - 416
Parkes, on the manufacture of edge tools, - - 198. 226
Parolic, or universal cement, Gill on the, - - - 203
Passive and active strength, 124. 193. - - - - - 230. 296
Patents, list of American, 62. 137. 284. - - - - - 356
———- English, 7. 66. 141. 286. 421
———- French, - 68. 142. 214
Paving carriage ways, *patent*, 179
Perfumes, a prevention of mouldiness, - - - 96
Perkins's remarks, Mr. S. Brown's letter on, - - - 206
Phenix Mill canvass, - 58
Plaster of Paris, copper-plate impressions on, - - 207
Pit saw, mode of fixing a frame for, 284
Pneumatic, or vacuum engine, 20
Polishing and blacking leather, composition for, - - 160
———— and silvering looking glasses, manner of, - 145. 241
Porcelain, Brogniart on colours for, 80
————- Cocks or taps, *patent*, 367
Portable folding ladder, - 372
Potato, on extracting the fecula from the, - - 52. 172
Power, Bakewell on loss of, 344
Press, for bookbinders, Burn's rolling, - - - 389
Press, Pouchee's new wheel and pinion standing, - - 355
Premium of the American academy, 133

Properties of iron, Descharmes on some, - - - 201
Propelling carriages by steam, Editor on, - - - 185
Purifying and obtaining gas, *patent*, 15
Pyrometer, Gurney's, - 371

Rafter, an improved, - 220
Raising water from mines, &c. *patent*, - - - 254
Rail-ways, suspension iron, *do.* 260
———— on sailing on, - 289
Rats and mice, to destroy, - 162
Red crayons, French mode of making, - - - 157
Refining ox gall, for painters, Tomkins's method of, - 175
Rice, for hulling, *patent*, - 309
—— cleaning paddy, or, *do.* 311
Roasting, calcining, and smelting ores, *patent*, - - 177
Rollers for calico printing, etched, *patent*, - - - 418
Rolling press, for bookbinders, 389
Roving and spinning, *patent*, - 31
Rumford premium of the American academy, - - 133

Safe coach, Skinner's improved, 353
Sailing on rail-ways, - 289
Saliman and Curadau's still, - 339
Salt pans, improved, *patent*, - 253
Saw, fixing and shifting frame of, 284
Scribbling, improvement in carding, and, *patent*, - - 257
Seals in wax, mode of taking impressions, - - 204
Self-generating gas lamp, - 32
Seneca oil, on the use of, - 36
Sheep and wool, observations on, 131
Ships, Carey's method of coppering, - - - 292
——— fastening with iron knees, 293
——— bottoms, cements for, 277
——— Barron, on dry rot in, - 405
Silvering and polishing looking glasses, manner of, - 145. 241
Silvered and gilt wood, recovering the metal from, - - 173
Smart's experiments on timber; and an improved rafter, - 220
Smelting, calcining, and roasting ores, *patent*, - - 177
Soda liquor, Cameron's method of making, - - 388
Solar compass, - - 209
Speculums for telescopes, Editor on, - - - 39
Speculums, Edwards on casting and grinding, - 40. 76. 148
Spinning and roving, *patent*, 31
Squaring numbers, new method of, 46
Stamping fine holes, *patent*, 256
Standing press, Pouchee's new wheel and pinion, - 355
Steam horse, - - 283
Steam, Editor on propelling carriages by, - - 185
——— carriages, - 187. 248
——— valve, - - 349
Steel and iron, gilding on, - 34
—— Barton's method of ornamenting, - - - 99
—— bluing, - - 130
Step, self-opening carriage, *patent*, 258
Still, Saliman and Curadau's, 339
—— liqueur, used in Paris, - 341
Straw paper, *patent*, - 416
Stress of journals, Tyler on, - 56
Strength, animal, - 109
———— active and passive, 124. 193
- - - 230. 296
Stumps of trees, method of eradicating, - - - 385

Tannin, extracting, *patent*, - 417
Terraces, water tight cement for, 120
Timber, Smart's experiments on, 220
———— Barron on dry rot in, 405
———— decay of American, inquiry, - - 412
Tin plate, on the manufacture of, 324. - - - - - 382
Townsend's Mechanics' Assistant, 60
Tools, edge, Parkes on the manufacture of, - - 198. 226
Trees, method of eradicating the stumps of, - - 385
Tritton's apparatus for distillation in vacuo, - - 332
Turning lathe, Tyler's improved, 61
Tyler on levers, and stress of journals, - - - 56

University, illiberal views on the London, - - - 90
Urn, Evans's improved coffee, 387

Vacuo, Tritton's apparatus for distillation in, - - 332
Vacuum, pneumatic engine, *patent*, - - - - 20
Valve, steam, - - 349
Vapour and gas engines, Editor's remarks on, - - 18

Vapour engine, *patent*, - 23
Variegated weaving, *patent*, - 263
Variations in the barometer, Espy on the cause of the diurnal, 278
Vessels, Capt. Dansey on a kite for relieving stranded, - - 280

Washing and bleaching, *patent*, 303
Washing emery, Hawkins on, 88
Watch and clock making, History, 151. - - - 245. 294
Water from mines, &c. raising, *patent* 254
—— on blast blowing by means of, 189. 236. 299. 379
Water tight cement for terraces, 120
—— wheel, communicating power from a, - - 350
Wax, impressions from seals in, 204
Weaving, variegated, *patent*, - 263
Weighing machine, Hawkins' hydraulic, - - - 336
Wheel and pinion standing press, Pouchee's, - - 355
White lead, improvement in manufacturing, - - 366
Wool and sheep, observations on, 131

NOTICES.

NEW ARRANGEMENT IN PUBLISHING AND DISTRIBUTING THE FRANKLIN JOURNAL.

The publishing office of the Franklin Journal, will, hereafter, be at the Hall of the Institute. The Editorial department will remain unchanged, but the work has become the property of the Franklin Institute. Mr. William Hamilton has been appointed *Actuary*, and all communications relating to the subscription to, or the distribution of the Journal, should, hereafter, be addressed to him at his office. Communications for insertion, or relating to the objects of the work, should be sent direct to the Editor.

The distribution of a widely extended periodical, requires the undivided attention of an individual; and it is believed, that the new arrangement will insure a more prompt and efficient management in this particular, than has hitherto been found to be practicable, notwithstanding the care of the late agent. Although the principal publication office will be at the Institute, Mr. Dobson will continue to aid in the diffusion of the work, and will communicate to the Editor, or to the Actuary, whatever concerns its interests.

Care will be taken, on the commencement of the next volume, to have the numbers issue simultaneously, at Philadelphia, and at the seat of the General Government.

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Subscribers who account with the agent in New York, are particularly requested to observe that Messrs. G. &. C. Carvill, of the city of New York, are now the only agents of the work there; *all payments*, whether for arrearages or otherwise, must be made to them alone

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